MODERN PLASTICS

MAY 1954

VACUUM FORMING of Rigid Thermoplastic Sheets
Offers New Savings, New Opportunities...Page 87

Want to perk up your products' appeal?

USE MODERN MATERIALS to make them better fitted for success in this new competitive period.

Thousands of products that only recently seemed incapable of improvement are today more salable because their manufacturers found new ideas to express in Durez phenolic plastics. Notable instances are the newest Landers, Frary and Clark 8- and 10-cup coffee percolators with their handsome, clean-lined contrasts of metal and plastic.

No materials lend themselves to many purposes more readily than Durez. Their catalog of properties includes outstanding resistance to heat, moisture, and chemicals. Electrical characteristics, easy moldability, and permanent lustrous finish are available for parts ranging from pea-size to single moldings of 35 pounds or more each.

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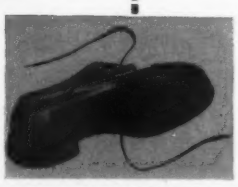
DUREZ

MOLDING COMPOUNDS. Structural, electrical, and chemical properties in many combinations

PHENOLIC PLASTICS

for the new Competitive Era



RESINS FOR INDUSTRY. Bonding, casting, coating, laminating, impregnating, and shell molding.

Yip-ee!... *The Wild and Wooly West—at its Best!*

—LIDO molded in "3D" of CATALIN *Styrene*

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"Terrific", shouts young America, as *he* spreads out his play table prairie! "Too bad Buffalo Bill and Kit Carson can't see me now!" (Somehow or other, Lad, we think they're watching you and applauding your fun.)

Combined assembly, pictured, was staged from the *perenially* popular, packaged sets shown in insert. A selling salute, too, to the lasting qualities of all playthings molded of high strength CATALIN STYRENE!

*LIDO TOY COMPANY, 321 Rider Ave., New York 51, N. Y.

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ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

May 1954 • Vol. 31, No. 9

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Be sure to see the B. F. Goodrich Chemical Company Exhibit at the 6th National Plastics Exposition Booth 727 Public Auditorium Cleveland, Ohio, June 7-10

B. F. Goodrich Chemical Company does not manufacture these plastic dip tubes. We supply the Geon resin only.

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RIGID plastic pipe made from Geon polyvinyl chloride helps cut down internal rust and corrosion in hot water heater tanks. The pipe, or "dip tube", was developed in the search for an answer to an old problem—electrolytic action between different metals used in hot water heaters which can cause corrosion through the steel tank itself.

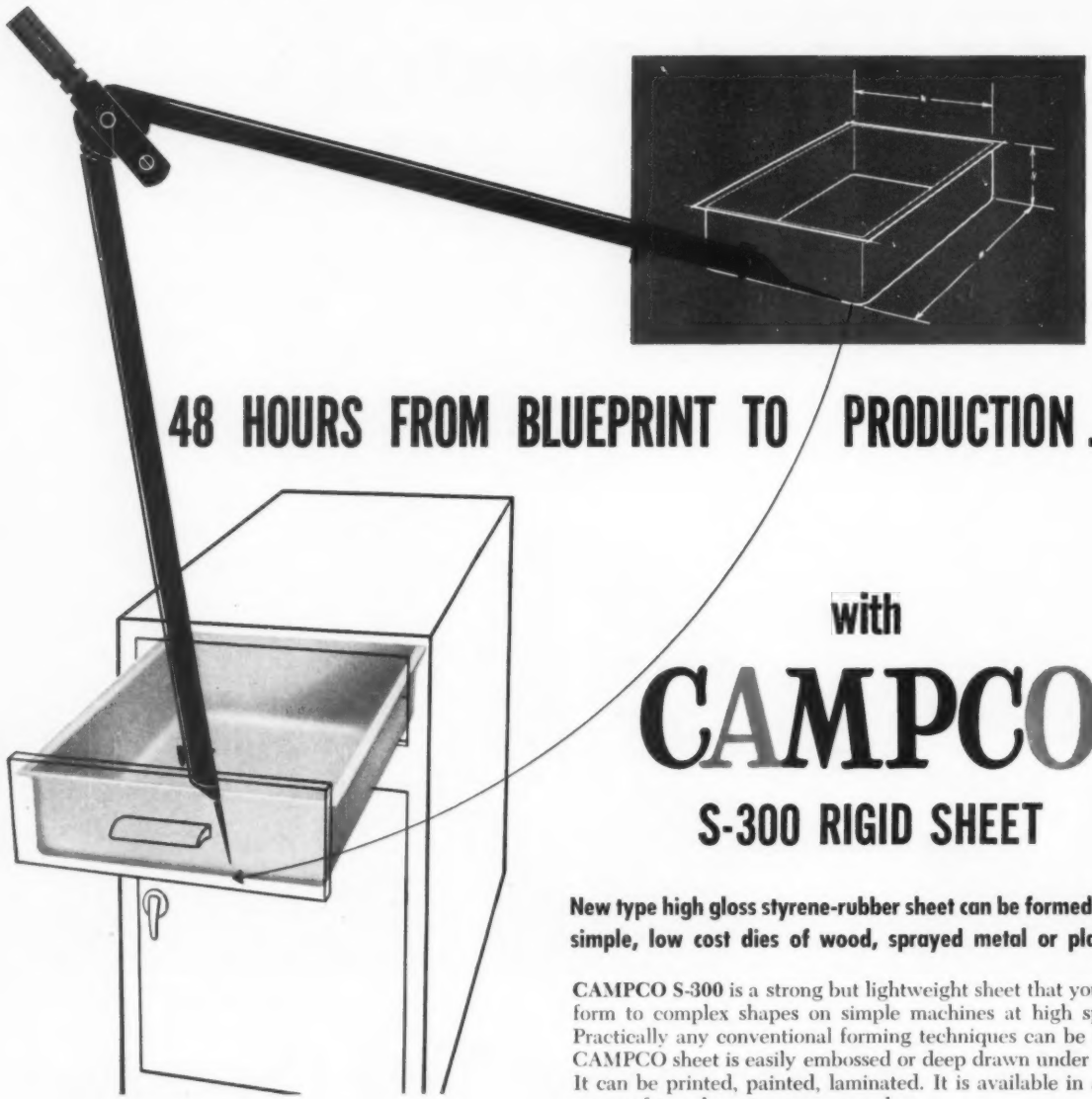
Because the dip tube is plastic, it does not promote this "battery action" inside the tank.

Geon resin was chosen for the dip tube after exhaustive tests of various plastics under all operating conditions. Perhaps a Geon material can help you reduce or eliminate corrosion where tubing, piping, ducts or tank linings are used. And, Geon materials have many more uses where resistance to many acids, chemicals and water is important. We'll help you select the one best suited to your needs. For information, please write Dept. GB-5, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

CHEMICAL PROGRESS WEEK-MAY 02

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors



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CAMPCO S-300's brilliant, porcelain-like gloss finish, high impact strength, low cost (26 to 28 cents per square foot in .080" thickness), excellent dimensional stability, low moisture absorption and good heat resistance to temperatures below boiling, result from the new techniques we use to produce this styrene and rubber alloy.

If you are now making, or contemplate making, a product in wood, glass, rigid vinyl, acetate, fibreboard, rubber, or, in some cases, even injection molded plastics, look at CAMPCO sheet first. It may mean greatly reduced die and production costs. It could mean increased product efficiency. Talk it over with our engineers. There's no obligation. Meanwhile, send in the coupon for full details on this remarkable new plastic sheet.

Widths from 20 to 58 inches
Thicknesses from .005 to .125 inch
Any desired length

Pilot production mold for drawer shown cost only $25. Mass production metal mold less than $500, and only 3 days to build.

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Chicago Molded Products Corporation
2721 Normandy Ave., Chicago 35, Illinois

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EDITORIAL

We Can Learn a Lot Abroad

We have a suggestion to make to molders, fabricators, extruders, and other processors of plastics: take your vacation in Europe this year and see what they're doing with plastics!

Following World War II, and with the help of ECA and MSA money put up by American taxpayers, a steady stream of plastics engineers and entrepreneurs from Britain and the continent of Europe began to visit the United Sates to watch our progress here. This stream of visitors continues to flow, the individuals who comprise it admittedly seeking know-how and new ideas.

And when these men get ideas, they go back to Europe and improve on them.

To date this has been a one-way movement of men from Europe to the United States on visits, and largely a one-way movement of methods and ideas from the United States to Europe.

In our surprising industrial provincialism (surprising because we maintain American military personnel in almost all countries and have wide trade liaison all over the world) we have been prone to become inflated with a sense of our own engineering, design, and manufacturing ability. The very fact that so many people come from Europe to see our operations helps to build up in us this sense of superiority.

Which is all wrong, as a few weeks' tour of plastics plants in England and on the continent will surely prove to any serious investigator.

Let's take some cases in point.

Item: Conveyor belts surfaced with polyvinyl chloride are becoming standard in England. None have been used in the United States.

Item: In rigid vinyl pipe and fittings and in sheet for fabrication, both the Italians and the Germans and English are years ahead of us.

Item: When they didn't have fibrous glass and poylester resins, the Europeans used asbestos and phenolics to make reinforced plastics structures with exceptional properties.

Item: In sheets for vacuum forming, particularly for outdoors use, and in methods of forming, there is much to be learned from Europe.

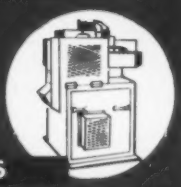
Certainly some visitors from Europe have copied our ideas and designs.

But the American processor, serene in his sense of superiority, has not bothered to try to learn anything from Europe.

There is much to be learned. And American visitors will be welcomed by plastics men in Europe who will be happy to have the opportunity of returning favors.

In Plastics Reducing Machinery, Look to CUMBERLAND for the COMPLETE LINE

GRANULATORS



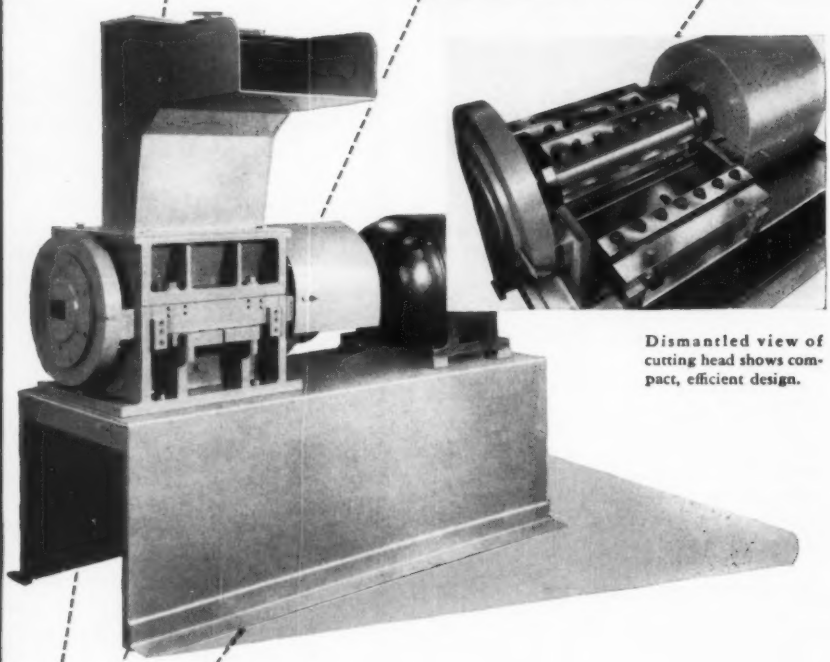
DICERS

CHOPPERS

PREBREAKERS

MODEL 20 All Steel Granulator

CUSTOM ENGINEERED QUALITY BUILT



Dismantled view of cutting head shows compact, efficient design.

1 HEAVY DUTY — Large flywheel—thick all-steel weldments—deep welds—parts are of flawless wrought steel (not steel castings)—machine resists wreckage.

2 LARGE THROAT OPENING — 8 by 20" size.

3 PRIOR BANDSAWING NOT NEEDED — Machine specially built to handle large chunky parts such as bleeder scrap, cylinder purgings and heavy cast slabs of polystyrene, modified polystyrene and acrylic resins.

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Memo
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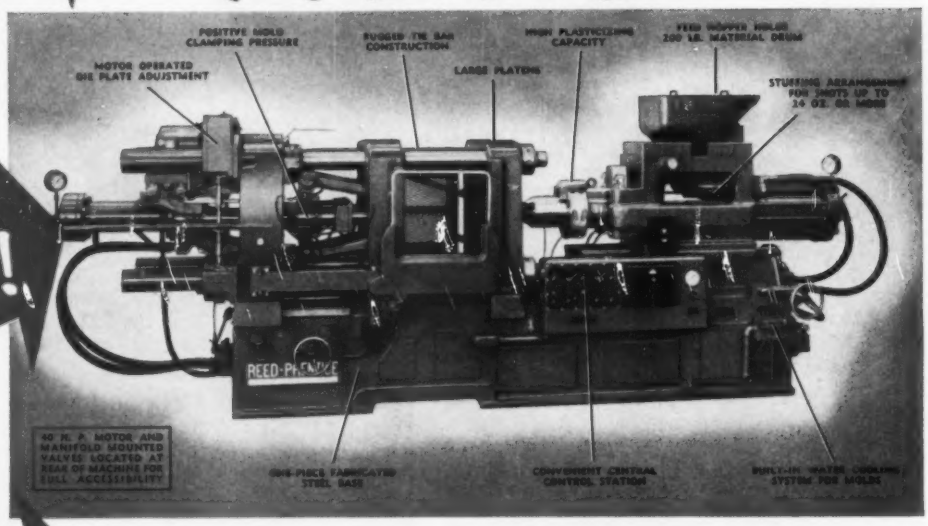
WIDER MARKETS
with GERING
Special Effects....

GP
PLASTIC MATERIALS

GERING PRODUCTS, Inc.

NEW 450T-20/24 oz. "REED"


POSITIVE MOLD CLAMPING PRESSURE
RUGGED TIE BAR CONSTRUCTION
HIGH PLASTICIZING CAPACITY
MOTOR OPERATED ONE PLATE ADJUSTMENT
LARGE PLATENS
STUFFING ARRANGEMENT FOR SHOTS UP TO 24 OZ. OR MORE
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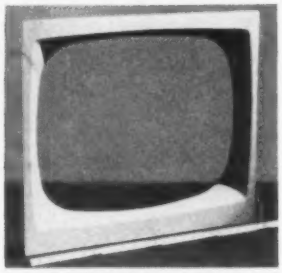
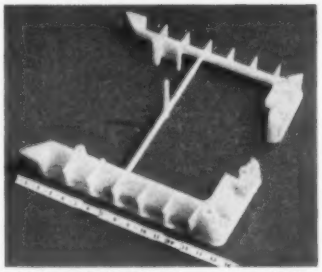
40 H. P. MOTOR AND MANIFOLD MOUNTED VALVES LOCATED AT REAR OF MACHINE FOR FULL ACCESSIBILITY
ONE-PIECE FABRICATED STEEL BASE
CONVENIENT CENTRAL CONTROL STATION

Compare Features!

Compare Performance!



22 oz. Television Mask for a 24" set molded on a 450T-20/24 oz. "Reed" is a product of Plastic-Ware, Inc., New York City.



Michigan Plastic Products, Inc., of Grand Haven, Michigan, molds A. M. I. Juke Box Louvre Grill in two-cavity shot weighing 22 ounces on their 450T-20/24 oz. "Reed".

Ability to handle molds up to 45 x 25½" . . . a full 16" stroke . . . and 450 tons positive mold clamping pressure make the new 450T-20/24 oz. Reed-Prentice injection molding machine the best investment in its range.

A built-in stuffing arrangement provides extra injection capacity up to 24 oz. or more per shot through multiple strokes. You can get full details on the 450T-20/24 oz. "Reed" by requesting Bulletin 753.

SPECIFICATIONS	450T-20/24
Mold clamping pressure, tons	450
Mold clamping stroke	16"
Platen size (Horiz. x Vert.)	45" x 40"
Mold size, maximum	45 x 25½"
Mold thickness, maximum	24"
Mold thickness, minimum	7"
Diameter of tie bars	5"
Rated casting area, sq. in.	200
Plasticizing capacity, lbs. per hour	135
Machine weight, lbs.	32,000

"Reeds" available in 4, 8, 12, 16, 20, 24, 32, 48 and 200 oz. capacity

INJECTION MACHINES

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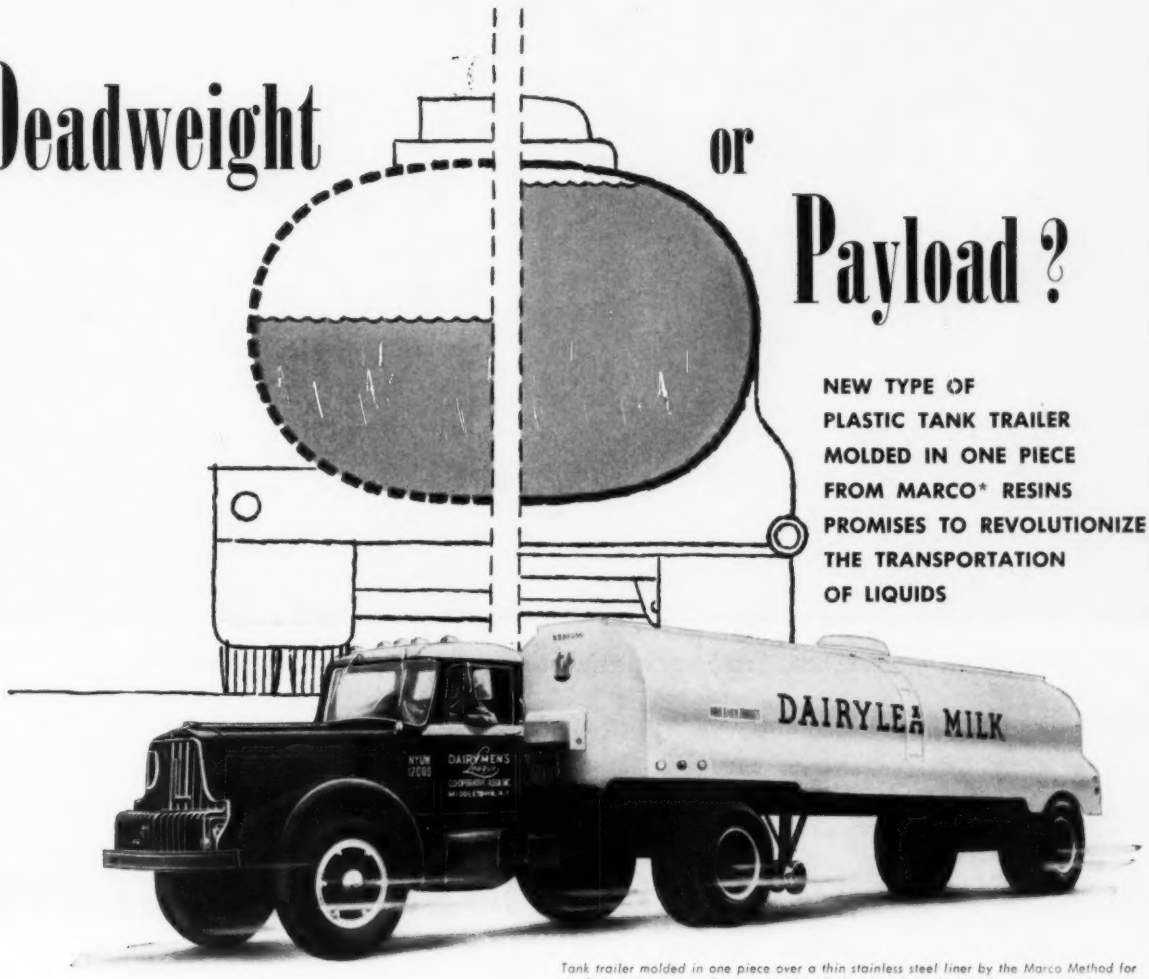
Deadweight or Payload ?

NEW TYPE OF PLASTIC TANK TRAILER MOLDED IN ONE PIECE FROM MARCO* RESINS PROMISES TO REVOLUTIONIZE THE TRANSPORTATION OF LIQUIDS



Tank trailer molded in one piece over a thin stainless steel liner by the Marco Method for the Dairymen's League Cooperative Association, Inc. Dust skirting, bumper, manhole cover and dry ice storage boxes also constructed of reinforced plastic. The light weight plastic construction offers a payload advantage of from 2,000 to 6,000 pounds. Brodix Corporation, builder . . . Insulation Associates, molders, Fanwood, N. J.

Meet the trailer that trades tons of weight for tons of added payload! Once a 4,000 gallon milk load on a single axle would be barred from New York State Highways. Now this new type of plastic trailer keeps this great load well under weight limitations. In the 3 months of its operation it has shown an operating revenue that should amortize the full cost of the trailer within 3 to 5 years.

Trailer trucks, molded of Celanese* Marco Polyester Resin and reinforced with glass cloth and mat, are practical for transporting many liquids. Marco Resins can produce molded structures that resist weather, moisture, heat, cold, vibration, impact and stress. Color can be molded in, and patch repairing can be done by an amateur.

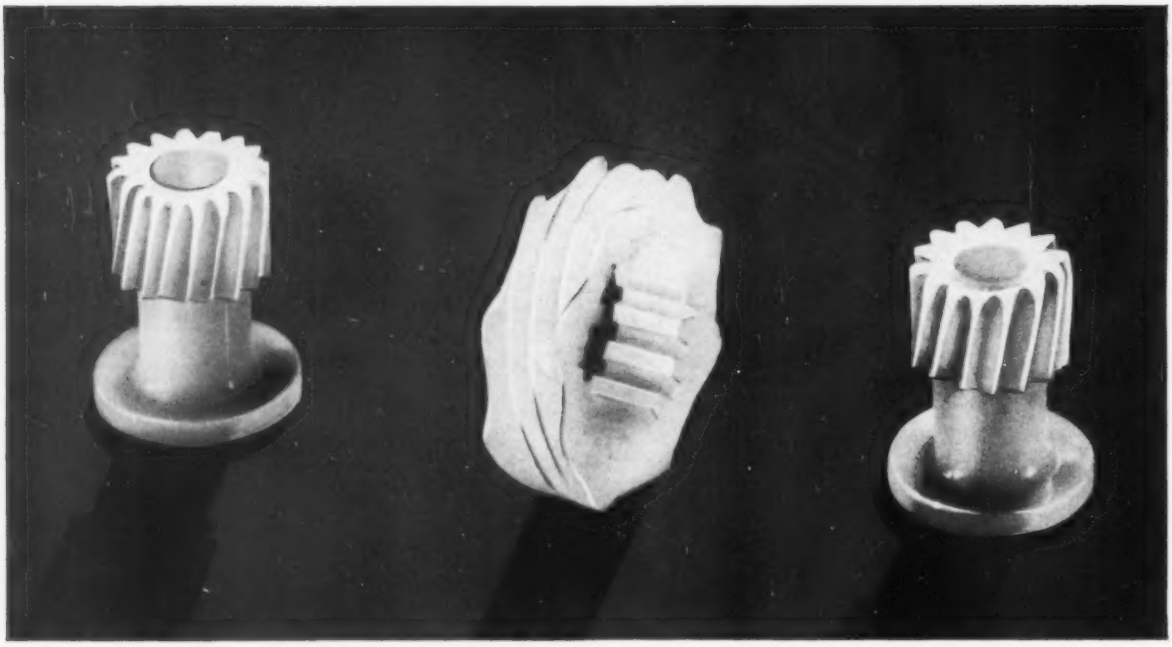
THE FIRST STRUCTURAL PLASTIC

Is there deadweight in your products . . . unnecessary weight that hampers consumer acceptance and increases shipping costs? Look into Marco Resins. Already they are producing better furniture, boats, car bodies, industrial piping and storage tanks, corrugated awnings and translucent window panes.

Write for the Marco Brochure prepared by a pioneer in polyesters, Celanese Corporation of America's Marco Products Dept., Plastics Division, Dept. 101-E, 290 Ferry Street, Newark 5, N. J. Canadian affiliate, Canadian Chemical Company Ltd., Montreal and Toronto.

Celanese*

*Reg. U. S. Pat. Off. **MARCO* POLYESTER RESINS**



A quiet, abrasion-resistant speedometer gear train of Du Pont **NYLON**

4 more examples of advanced

Many industries have felt the impact of the Du Pont family of plastic engineering materials—Du Pont nylon, "Alathon" polyethylene resin, "Teflon" tetrafluoroethylene resin and "Lucite" acrylic resin. Each material has a unique combination of properties. And with these properties, molders working with manufacturers have engineered new products that work better and last longer . . . are more economical to produce and maintain. Here are four examples:

Du Pont nylon is used for the transmission governor pin and speedometer driving gear in Packard's Ultramatic Drive. This all-nylon speedometer drive assembly operates quietly because nylon damps noise and vibration. Its lightness has produced a weight saving of 87%. These nylon gears are exceptionally wear-resistant—ran for 48,463 miles at the Packard Proving Grounds without showing perceptible wear. Another big advantage: they are mass-produced in four-cavity dies quickly and at a substantial saving in production costs.

"Alathon"* polyethylene resin has added new production economy and operating efficiency for still another product—the simple flashlight. The battery section, lens retaining ring and end cap of this Gits flashlight are economically molded of lightweight "Alathon." This flashlight case is unbreakable, dent-proof and corrosion-resistant. Its resiliency cushions blows to protect the bulb filament from damage. Because "Alathon" has excellent dielectric properties, contact points leading to the switch don't need insulation. And "Alathon" makes this flashlight water-resistant.

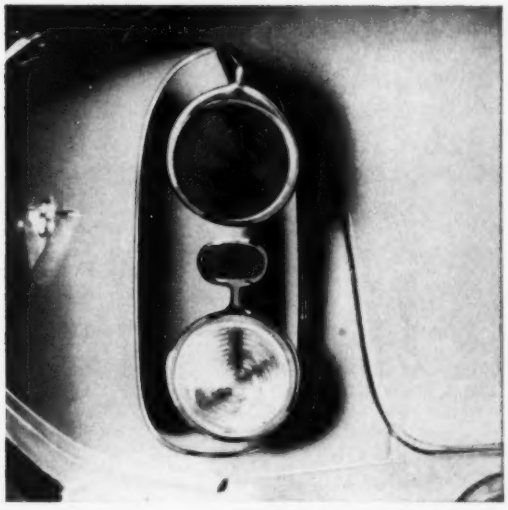
"Teflon"* tetrafluoroethylene resin is used in the expansion joint made by the United States Gasket Co. These expansion joints of "Teflon" protect costly process equipment from damage by absorbing vibration, correcting for misalignment, and correcting for expansion and contraction of equipment due to temperature change. They resist chemical attack and are non-contaminating. "Teflon" can be used over a wide temperature range—assures these expansion joints of long life and dependable service.

"Lucite"* acrylic resin, used for the tail light at right, has a beauty that's surpassed by no other plastic engineering material. Articles molded of "Lucite" can be produced either sparkling-clear or in sparkling color. "Lucite" is lightweight and shatter-resistant . . . resists chemicals and has good dimensional stability. Lenses made of "Lucite" glow brightly and are visible at great distances.

A strong, corrosion-resistant flashlight case of **"ALATHON"**

An expansion joint of chemically inert **"TEFLON"**

product engineering



A sparkling-clear, shatter-resistant tail-light lens of **"LUCITE"**

Investigate the properties of the Du Pont family of plastic engineering materials. The applications described on these pages are typical of the product improvements made possible when design and service requirements are evaluated in terms of these unique engineering materials. For further information on the properties and uses of these materials, use the coupon at the right or write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 305, Du Pont Building, Wilmington 98, Delaware.

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Room 305, Du Pont Building, Wilmington 98, Del.

Please send me more information on the Du Pont plastic engineering materials checked: ☐ Du Pont nylon; ☐ "Alathon" polyethylene resin; ☐ "Teflon" tetrafluoroethylene resin; ☐ "Lucite" acrylic resin. I am interested in evaluating these materials for _____

_____

Name _____ Position _____

Firm Name _____

Street Address _____

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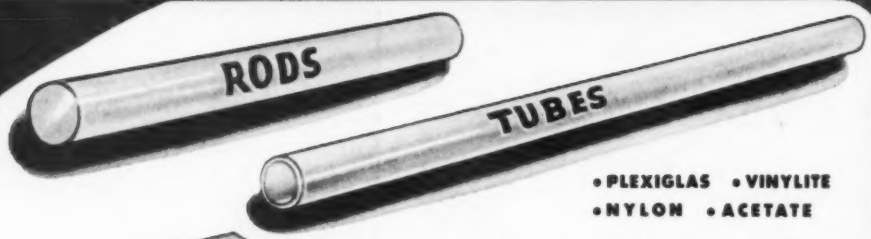
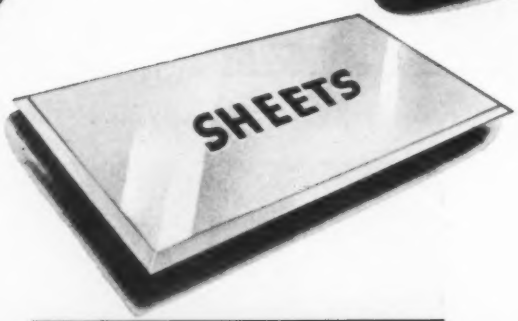
Type of Business _____

Largest complete source for plastics in AMERICA . . . . .

CADILLAC



• PLEXIGLAS • VINYLITE
• NYLON • ACETATE



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cadillac plastic company

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Chicago Warehouse, 727 Lake Street
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Can you name 33 topflight resin manufacturers?

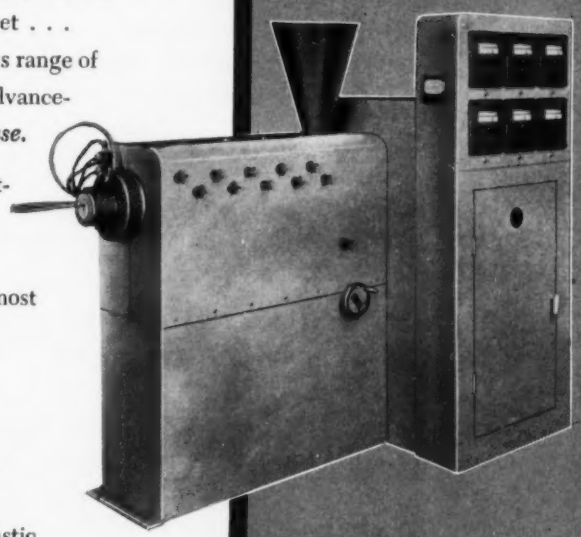
We can... because they all have purchased MPM extruders!

mpm Take the common thermoplastics—polyethylene, styrene, vinyl chloride, cellulose acetate; take the uncommon ones—vinyl formal, vinyl butyral, the fluorothenes; take those that are still being put through their paces in the laboratories and that haven't even been named yet . . . and you will begin to get an idea of the enormous range of materials that are being extruded on the same advance-design MPM extruders you can buy for *your own use.*

As a direct outgrowth of MPM's superior heating and cooling system, temperature control, screw speed control, and corrosion-resistant construction, thirty-three of the country's foremost manufacturers of thermoplastics have chosen them for *their own use.*

What do they use them for? For spot-checking current production; for color blending; for development work on behalf of their customers; for extruding experimental thermoplastic compounds.

The very fact that MPM extruders are so popular with so many resin suppliers is conclusive proof that they rate "tops" for versatility and reliable performance. We will gladly send you details. Write today.



This is the world-famous MPM 2½" extruder

modern plastic machinery corp. mpm

15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

West Coast Representative:
4113 W. Jefferson St., Los Angeles 16, Calif.

HIGH IMPACT AT HIGH SPEEDS

now possible with injection molding Plio-Tuf

Now you can turn out highly impact-resistant, heat-resistant, molded goods at injection speed with PLIO-TUF. This great, new, high styrene copolymer is now available in the first of a series of convenient to use, granulated colored compounds.

The new PLIO-TUF pigmented granules permit injection molders to capitalize on these outstanding features of the PLIO-TUF resins: Unmatched impact strength. Unusual high heat resistance. Hardness. Rigidity. High tensile strength. Excellent chemical and electrical resistance.

PLIO-TUF color granules are especially made for injection molding in conventional equipment at normal temperatures. Molding characteristics allow close tolerances to be met. Stability of color is excellent and scrap has been recycled with negligible changes in color and physical properties.

Not only for use in injection molded products, color compounds can be extruded into wide sheets for post-forming intricate shapes of almost any size. PLIO-TUF resins are also available in powder form for color compounding in your own equipment.

If you mold, extrude or post-form plastics, and toughness and durability are what you're looking for, then investigate PLIO-TUF today. A postcard or letter will be answered promptly with literature, followed by samples and full technical help. Just write to:

Goodyear, Chemical Division, Akron 16, Ohio

SEE THE PLIO-TUF RESINS—featured in Goodyear Chemical Division exhibits at the Basic Materials Show—May 17-20, 1954—Chicago—and the National Plastics Exposition—June 7-10, 1954—Cleveland.

CHEMICAL GOODYEAR DIVISION

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry

NOW YOU CAN ADD injection molding to many other methods of forming and fabricating the versatile PLIO-TUF resins. Easy molding PLIO-TUF is now available in pigmented granules. Photo courtesy The West Company.

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

MANUFACTURERS[1]	TRADE NAME	METHOD OF MANUFACTURE	THICKNESS	SHEET SIZE WIDTH[2] IN.	SHEET SIZE LENGTH[2] IN.	COLORS[3]	FINISHES
STYRENE, STYRENE ALLOYS, STYRENE COPOLYMERS							
ACADIA SYNTHETIC PRODUCTS Div. Western Felt Works 415 Ogden Ave., Chicago, Ill.		Compression Molded	0.030 to 0.060	20 24	20 24	Clear transparent	Press polished
ALLIED RESINOUS PRODUCTS, INC. P.O. Box 461, Conneaut, Ohio	Resiston	Compression Molded	0.060 to 1.000	36 48	60 72	Unlimited opaque color range [4]	Press polished
ATLAS MINERAL PRODUCTS CO. Mertztown, Pa.	Ampcolite	Calendered & Laminated	0.060 to 1.000	48	108	Unlimited opaque color range	Press polished
AUBURN BUTTON WORKS, INC. 48 Canoga Road, Auburn, N. Y.		Extruded	0.010 to 0.200	42	108	Unlimited opaque color range	Semi-Matte; glossy; high polish one side
BOLTA PRODUCTS SALES, INC. 70 Garden St., Lawrence, Mass.	Boltaron	Calendered	0.015 to 0.375	32 35	62 72	Unlimited opaque color range	Matte, grains, and glossy
CAMPCO, Div. Chicago Molded Products Corp. 1020 N. Kolmar Ave., Chicago, Ill.	Campco S-300	Extruded	0.005 to 0.125	20 to 59	20 to 96	Unlimited opaque color range	Matte to glossy
CAST OPTICS CORP. 1010 Post Rd., Riverside, Conn.	Cocor CP-1	Cast	0.125 to 1.000	36 to 60	48 to 96	Clear transparent; white; red	Glossy
JOSEPH DAVIS PLASTICS CO. Arlington, N. J.		Extruded	0.005 to 0.125	60	Continuous	Unlimited opaque color range	Matte to glossy
DOW CHEMICAL CO., THE Midland, Mich.	Styron 475	Extruded	0.040 to 0.080	24 to 40	24 to 96	Unlimited opaque color range	Matte to glossy
GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.010 to 0.125	40	Continuous	Unlimited opaque color range	Matte, as extruded
GERING PRODUCTS, INC. N. 7 St. & Monroe Ave., Kenilworth, N.J.		Extruded	0.005 to 0.125	54	54	Unlimited opaque color range	Matte, as extruded
GILMAN BROS. CO. Gilman, Conn.		Extruded	0.010 to 0.125	to 48	Continuous	Unlimited opaque color range	Matte to polished
KAYKOR INDUSTRIES Yardville, N.J.	Vyflex "R"	Calendered Calendered & Laminated	0.015 to 0.038 0.030 to 0.500	54 44	Continuous 120	Unlimited opaque color range	Press polished
LUS-TRUS EXTRUDED PLASTICS, INC. 200 Hill St., Ann Arbor, Mich.		Extruded	0.010 to 0.080	40	60	Unlimited opaque color range	Matte, as extruded
MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon H-I	Extruded	0.010 to 0.125	40	Continuous	Unlimited opaque color range	Matte, as extruded
NIXON NITRATION WORKS Nixon, N.J.		Extruded	0.010 to 0.250	22 25	52 72	Unlimited opaque color range	Matte to glossy
PLAX CORP. Box 1019, Hartford, Conn.	Polyflex I Polyflex II	Biaxial Orientation Extrusion	0.003 to 0.020	20 to 43	Continuous	Clear transparent; unlimited opaque color range	Glossy
PLASTEX CO. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	24 36	72 72	Clear transparent; translucent white; unlimited opaque color range	Glossy, as extruded
SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited opaque color range	Matte to semi-glossy
SOUTHERN PLASTICS CO. Columbia, S.C.	Soplasco	Extruded	0.030 to 0.125	48	Continuous	Clear transparent; unlimited opaque color range	Matte to semi-glossy
U.S. RUBBER CO. 2638 N. Pulaski Rd., Chicago, Ill.	Royalite	Calendered	0.010 to 0.250	52	86	Unlimited opaque color range	Matte, grains, and glossy

PHYSICAL PROPERTIES	FLEXURAL STRENGTH p.s.i.	TENSILE STRENGTH p.s.i.	SPECIFIC GRAVITY	IZOD IMPACT ft. lb./in. of notch	COEFFICIENT OF EXPANSION 10^5/in./in./oC.	WATER ABSORPTION %, 24 hr.	RESISTANCE TO OUTDOOR WEATHERING	RESISTANCE TO INDOOR AGING
Styrene Alloy	10,000-17,000	3,200-5,000	1.04-1.07	0.6-3.0	6.5-8.5	0.1	Fair	Excellent
Styrene Copolymer	6,000-9,000	3,500-4,500	1.05-1.15	0.4-9.0	6.1	0.4-0.5	Fair	Excellent
Acrylic	13,000-17,000	7,000-8,000	1.18-1.19	0.4-0.5	7-9	0.3-0.4	Excellent	Excellent
Vinyls	12,600-14,500	7,200-9,000	1.35-1.45	0.4-0.75	6.9-18.5	0.07-0.08	Fair	Excellent
Cellulose Acetate	4,000-11,000	4,500-8,000	1.28-1.32	1.0-3.7	8-16	2.7-4.0	Fair	Excellent
Cellulose Acetate Butyrate	4,000-9,000	2,600-6,900	1.15-1.22	0.8-6.3	11-17	0.9-2.2	Good	Excellent

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[1] This chart lists only manufacturers and processors of rigid thermoplastic sheets which are sold to vacuum formers. Distributors are not listed. Chart includes only the five types of rigid thermoplastic sheet most commonly used in the vacuum forming industry.

[2] Since most of the sheets listed in this chart are extruded continuously, they can be supplied to fit individual customer requirements as to length. All listed sheet sizes, 20 to 21 in. in width and 50 to 52 in. in length, in such cases, indicate standard sizes which can be supplied from stock. All other figures for extruded sheet indicate maximum sizes which can be cut.

[3] Color range in thermoplastics sheets is virtually unlimited. Although each company stocks a number of standard colors, special colors can be custom made.

[4] Transparent colors are presently unavailable in styrene alloys and styrene copolymers.

[5] Do not manufacture acetate or butyrate sheet, but process such a sheet by metallizing it.

INE'S Chart of Vacuum Formable Rigid 1

MANUFACTURERS[1]	TRADE NAME	METHOD OF MANUFACTURE	THICKNESS	SHEET SIZE WIDTH[2] IN.	SHEET SIZE LENGTH[2] IN.	COLORS[3]	FINISHES
CELLULOSE ACETATE							
ACADIA SYNTHETIC PRODUCTS Div. Western Felt Works 415 Ogden Ave., Chicago, Ill.		Compression Molded	0.030 to 0.500	20 24	20 24	Clear transparent; unlimited transparent, translucent, and opaque colors	Press polished
CELANESE CORP. OF AMERICA Plastics Div. 290 Ferry St., Newark, N.J.	S704 & S719	Extruded	0.005 to 0.250	54	51 to 61	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
COATING PRODUCTS[5] 101 W. Forest Ave., Englewood, N.J.	Mirro-Brite (Metallized Acetate)	Metallized Acetate Sheet	0.010 to 0.030	21	Continuous	Metallic colors, opaque, translucent and transparent	Glossy and textured
COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.		Extruded	0.003 to 0.250	21	50	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
JOSEPH DAVIS PLASTICS CO. Arlington, N. J.		Extruded	0.005 to 0.125	to 60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
EASTMAN KODAK CO. 343 State St., Rochester, N.Y.	Kodapak I	Cast	0.005 to 0.020	20	50	Clear transparent	Matte to polished
GOMAR MFG. CO.[5] 79 Paris St., Newark, N. J.	Gomarized (Metallized Acetate)	Metallized Acetate Sheet	0.005 to 0.020	21	50	Metallic colors, opaque and transparent	Glossy and textured
KINGSBACHER-MURPHY CO. 6245 Lexington Ave., Hollywood, Calif.	KM-3 KM-5	Extruded	0.003 to 0.020	36	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Semi-Matte to polished
LINEHAN & Co. 2062 Irving Blvd., Dallas, Texas		Extruded	0.002 to 0.020	42	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.005 to 0.125	60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon A	Extruded	0.010 to 0.060	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
NIXON NITRATION WORKS Nixon, N.J.	Nixon C/A	Extruded	0.010 to 0.250	21½ 25	51½ 60	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
PLASTEX CORP. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	36	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
SHOE FORM CO., INC. AUBURN, N. Y.		Extruded	0.020 to 0.060	20 24	50 Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
SOUTHERN PLASTICS CO. Columbia, S. C.	Soplasco	Extruded	0.020 to 0.080	30	Continuous	Unlimited transparent, translucent and opaque colors	Glossy, as extruded
CELLULOSE ACETATE BUTYRATE							
AUBURN BUTTON WORKS 48 Canoga Rd. Auburn, N. Y.		Extruded	0.005 to 0.125	20	108	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
COATING PRODUCTS[5] 101 W. Forest Ave., Englewood, N. J.	Mirro-Brite (Metallized Butyrate)	Metallized Butyrate Sheet	0.010 to 0.030	21	Continuous	Metallic colors, opaque, translucent, and transparent	Glossy and textured
JOSEPH DAVIS PLASTICS CO. Arlington, N. J.		Extruded	0.005 to 0.125	60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded and polished
EASTMAN KODAK CO. 343 State St., Rochester, N.Y.	Kodapak II	Extruded	0.010 to 0.080	21	51	Clear transparent	Glossy, as extruded; matte; press polished
GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.010 to 0.125	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
GOMAR MFG. CO., INC.[5] 79 Paris St., Newark, N. J.	Gomarized (Metallized Butyrate)	Metallized Butyrate Sheet	0.010 to 0.030	21	50	Metallic colors, opaque, translucent, and transparent	Glossy and textured
KINGSBACHER-MURPHY CO. 6245 Lexington Ave., Hollywood, Calif.	KM-1B	Extruded	0.005 to 0.020	36	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Semi-matte to polished
LINEHAN AND CO. 2062 Irving Blvd., Dallas, Tex.		Extruded	0.002 to 0.020	42	Continuous	Clear transparent; unlimited transparent, translucent and opaque colors	Glossy, as extruded
MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon B	Extruded	0.010 to 0.100	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
NIXON NITRATION WORKS Nixon, N. J.	Nixon C/A/B	Extruded	0.010 to 0.250	21½ 25	51½ 60	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
PLASTEX CO. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	24 36	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
SHOE FORM CO., INC. Auburn, N. Y.		Extruded	0.020 to 0.060	20	50	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
SOUTHERN PLASTICS CO. Columbia, S.C.	Soplasco	Extruded	0.020 to 0.080	30	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy as extruded

MANUFACTURERS[1]
ACRYLIC
ACRYVIN CORP. OF AMERICA 454 E. 99 St. Brooklyn, N. Y.
CAST OPTICS CORP. 1010 Post Rd., Riverside Conn.
COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.
GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.
IMPERIAL CHEMICAL INDUST LTD. Welwyn Garden City, Herts, England
MIDWEST PLASTIC PRODUCTS 1801 Chicago Rd., Chicago Heights, Ill.
PLASTEX CORP. 402 Mt. Vernon Ave., Columbus, Ohio
PLASTIC GLASS CORP. 33 Ave. P, Newark, N.J.
PLAX CORP. Box 1019, Hartford, Conn.
ROHM & HAAS CO. Washington Sq., Philadelphia, Pa.
SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.
SHEFFIELD PLASTICS, INC. Salisbury Rd. Sheffield, Mass.
SOUTHERN PLASTICS CO. Columbia, S. C.
U.S. PLASTIC PRODUCTS CO Box 49, Metuchen, N. J.
POLYVINYL C
ACADIA SYNTHETIC PRODUCT DIV. Western Felt Works 415 Ogden Ave., Chicago, Ill.
ATLAS MINERAL PRODUCTS C Hertztown, Pa.
BX PLASTICS LTD. Higham Station Ave., Chingford, London E., England
BAKELITE CO. Div. Union Carbide & Carbo 30 E. 42 St., New York 17, N.Y.
COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.
IMPERIAL CHEMICAL INDUST LTD. Welwyn Garden City, Herts, England
KAYKOR INDUSTRIES Yardville, N.J.
NIXON NITRATION WORKS Nixon, N.J.
PAN LAMINATES, INC. 444 Madison Ave., New York, N.Y.
RESPRO, INC. 530 Wellington Ave., Cranston, R.I.
SEIBERLING RUBBER CO. Plastics Div., Akron 9, Ohio
SOUTHERN PLASTICS CO. Columbia, S.C.
WHITMAN PLASTICS CORP. 655 Summer St., Lynn, Mass.

\GAZINE'S Chart of Vacuum Formable

FINISHES		MANUFACTURERS[1]	TRADE NAME	METHOD OF MANUFACTURE	THICK-NESS	SHEET SIZE WIDTH[2] IN.	SHEET SIZE LENGTH[2] IN.	COLORS[3]	FINISHES
		CELLULOSE ACETATE							
	Press polished	ACADIA SYNTHETIC PRODUCTS Div. Western Felt Works 415 Ogden Ave., Chicago, Ill.		Compression Molded	0.030 to 0.500	20 24	20 24	Clear transparent; unlimited transparent, translucent, and opaque colors	Press polished
	Press polished	CELANESE CORP. OF AMERICA Plastics Div. 290 Ferry St., Newark, N.J.	S704 & S719	Extruded	0.005 to 0.250	54	51 to 61	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
	Press polished	COATING PRODUCTS[5] 101 W. Forest Ave., Englewood, N.J.	Mirro-Brite (Metallized Acetate)	Metallized Acetate Sheet	0.010 to 0.030	21	Continuous	Metallic colors, opaque, translucent and transparent	Glossy and textured
	Semi-Matte; glossy; high polish one side	COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.		Extruded	0.003 to 0.250	21	50	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
	Matte, grains, and glossy	JOSEPH DAVIS PLASTICS CO. Arlington, N. J.		Extruded	0.005 to 0.125	to 60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
	Matte to glossy	EASTMAN KODAK CO. 343 State St., Rochester, N.Y.	Kodapak I	Cast	0.005 to 0.020	20	50	Clear transparent	Matte to polished
	Glossy	GOMAR MFG. CO.[5] 79 Paris St., Newark, N. J.	Gomarized (Metallized Acetate)	Metallized Acetate Sheet	0.005 to 0.020	21	50	Metallic colors, opaque and transparent	Glossy and textured
	Matte to glossy	KINGSBACHER-MURPHY CO. 6245 Lexington Ave., Hollywood, Calif.	KM-3 KM-5	Extruded	0.003 to 0.020	36	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Semi-Matte to polished
	Matte to glossy	LINEHAN & Co. 2062 Irving Blvd., Dallas, Texas		Extruded	0.002 to 0.020	42	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
	Matte, as extruded	GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.005 to 0.125	60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
	Matte, as extruded	MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon A	Extruded	0.010 to 0.060	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
	Matte to polished	NIXON NITRATION WORKS Nixon, N.J.	Nixon C/A	Extruded	0.010 to 0.250	21½ 25	51½ 60	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
	Press polished	PLASTEX CORP. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	36	Continuous	Clear transparent; unlimited transparent, tranlucent, and opaque colors	Glossy, as extruded
	Matte, as extruded	SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
	Matte, as extruded	SHOE FORM CO., INC. AUBURN, N. Y.		Extruded	0.020 to 0.060	20 24	50 Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and polished
	Matte to glossy	SOUTHERN PLASTICS CO. Columbia, S. C.	Soplasco	Extruded	0.020 to 0.080	30	Continuous	Unlimited transparent, translucent and opaque colors	Glossy, as extruded
	Glossy	**CELLULOSE ACETATE BUTYRATE**							
	Glossy, as extruded	AUBURN BUTTON WORKS 48 Canoga Rd. Auburn, N. Y.		Extruded	0.005 to 0.125	20	108	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
	Matte to semi-glossy	COATING PRODUCTS[5] 101 W. Forest Ave., Englewood, N. J.	Mirro-Brite (Metallized Butyrate)	Metallized Butyrate Sheet	0.010 to 0.030	21	Continuous	Metallic colors, opaque, translucent, and transparent	Glossy and textured
	Matte to semi-glossy	JOSEPH DAVIS PLASTICS CO. Arlington, N. J.		Extruded	0.005 to 0.125	60	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded and polished
	Matte, grains, and glossy	EASTMAN KODAK CO. 343 State St., Rochester, N.Y.	Kodapak II	Extruded	0.010 to 0.080	21	51	Clear transparent	Glossy, as extruded; matte; press polished
		GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.010 to 0.125	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
		GOMAR MFG. CO., INC.[5] 79 Paris St., Newark, N. J.	Gomarized (Metallized Butyrate)	Metallized Butyrate Sheet	0.010 to 0.030	21	50	Metallic colors, opaque, translucent, and transparent	Glossy and textured
		KINGSBACHER-MURPHY CO. 6245 Lexington Ave., Hollywood, Calif.	KM-1B	Extruded	0.005 to 0.020	36	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Semi-matte to polished
		LINEHAN AND CO. 2062 Irving Blvd., Dallas, Tex.		Extruded	0.002 to 0.020	42	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
		MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon B	Extruded	0.010 to 0.100	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
		NIXON NITRATION WORKS Nixon, N. J.	Nixon C/A/B	Extruded	0.010 to 0.250	21½ 25	51½ 60	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded, and press polished
		PLASTEX CO. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	24 36	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
		SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
		SHOE FORM CO., INC. Auburn, N. Y.		Extruded	0.020 to 0.060	20	50	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
		SOUTHERN PLASTICS CO. Columbia, S.C.	Soplasco	Extruded	0.020 to 0.080	30	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy as extruded

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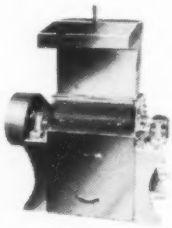
MANUFACTURERS[1]	TRADE NAME	METHOD OF MANUFACTURE	THICKNESS	SHEET SIZE		COLORS[3]	FINISHES
				WIDTH[2] IN.	LENGTH[2] IN.		
ACRYLIC							
ACRYVIN CORP. OF AMERICA 454 E. 99 St. Brooklyn, N. Y.		Cast	0.100 to 1.000	36	48	Pearl: unlimited opaque and translucent colors	Polished
CAST OPTICS CORP. 1010 Post Rd., Riverside Conn.	Cocor CO-4	Cast	0.040 to 0.250	36	48	Clear transparent; white; red	Polished
COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.		Cast	0.040 to 1.000	12	120	Clear transparent, unlimited transparent, translucent, and opaque colors	Polished
GENERAL PLASTICS CORP. 1400 N. Washington, Marion, Ind.		Extruded	0.040 to 0.125	40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
IMPERIAL CHEMICAL INDUSTRIES LTD. Welwyn Garden City, Herts, England	Perspex	Cast	0.040 to 1.000	48	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Polished
MIDWEST PLASTIC PRODUCTS CO. 1801 Chicago Rd., Chicago Heights, Ill.	Midlon M	Extruded	0.040 to 0.125	to 40	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
PLASTEX CORP. 402 Mt. Vernon Ave., Columbus, Ohio		Extruded	0.040 to 0.100	24 36	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
PLASTIC GLASS CORP. 33 Ave. P, Newark, N.J.		Cast	0.060 to 1.000	36	48	Clear transparent; pearl; unlimited transparent, translucent, and opaque colors	Polished
PLAX CORP. Box 1019, Hartford, Conn.	Methaflex	Biaxial Orientation Extrusion	0.005 to 0.020	20 to 43	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
ROHM & HAAS CO. Washington Sq., Philadelphia, Pa.	Plexiglas	Cast	0.060 to 1.000	36 to 100	48 to 120	Clear transparent; unlimited transparent, translucent, and opaque colors	Polished
SANDEE MFG. CO. 5050 W. Foster Ave., Chicago, Ill.		Extruded	0.020 to 0.156	58	120	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
SHEFFIELD PLASTICS, INC. Salisbury Rd. Sheffield, Mass.		Extruded	0.060 to 0.125	24	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
SOUTHERN PLASTICS CO. Columbia, S. C.	Soplasco	Extruded	0.030 to 0.187	48	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Glossy, as extruded
U.S. PLASTIC PRODUCTS CORP. Box 49, Metuchen, N. J.	Lusterlite	Cast	0.100 to 0.375	36	48	Smooth Pearl - standard white; unlimited opaque colors Design Pearl - 15 standard colors	Polished
POLYVINYL CHLORIDE AND VINYL COPOLYMERS							
ACADIA SYNTHETIC PRODUCTS DIV. Western Felt Works 415 Ogden Ave., Chicago, Ill.		Compression Molded	0.030 to 0.060	20 24	20 24	Clear transparent; unlimited transparent, translucent, and opaque colors	Polished
ATLAS MINERAL PRODUCTS CO. Hertztown, Pa.	Ampcoflex Pee-Vee-Cee	Calendered & Laminated Extruded & Laminated	0.060 to 1.000	48	108	Amber and Black Gray	Matte to press polished
BX PLASTICS LTD. Higham Station Ave., Chingford, London E., England	Cobex	Calendered	0.010 to 1.000	48	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte; glazed
BAKELITE CO. Div. Union Carbide & Carbon Corp. 30 E. 42 St., New York 17, N.Y.	Bakelite	Calendered Planished	0.010 to 0.030 0.010 to 0.125	21½ 20	51½ 50	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte Press polished or matte one side
COMMERCIAL PLASTICS AND SUPPLY CORP. 630 Broadway, New York, N.Y.		Calendered	0.010 to 0.125	21	51½	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
IMPERIAL CHEMICAL INDUSTRIES LTD. Welwyn Garden City, Herts, England	Darvic	Calendered	0.030 to 0.160	48	72	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
KAYKOR INDUSTRIES Yardville, N.J.	Vyflex L-92 Vyflex L-92	Calendered Calendered & Laminated	0.012 to 0.025 0.060 to 1.000	54 48	Continuous 108	Gray	Matte to press polished
NIXON NITRATION WORKS Nixon, N.J.	Nixon V/L	Calendered	0.010 to 0.250	21½ 30	51½ 60	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
PAN LAMINATES, INC. 444 Madison Ave., New York, N.Y.	Panlam	Laminated	0.015 to 0.250	48	71½ to 96	Decorative effects achieved by laminating fibers between clear and colored vinyl sheets	Matte to press polished
RESPRO, INC. 530 Wellington Ave., Cranston, R.I.	Respro X-9100	Calendered Calendered & Laminated	0.005 to 0.020 0.010 to 0.020	52 21½	Continuous 51½	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte to press polished
SEIBERLING RUBBER CO. Plastics Div., Akron 9, Ohio	Seilon 8700-4	Calendered Calendered & Laminated	0.015 to 0.025 0.030 to 0.125	40-48 48	Continuous 72	Gray and White	Matte to press polished
SOUTHERN PLASTICS CO. Columbia, S.C.	Soplasco	Extruded	0.020 to 0.060	to 30	Continuous	Clear transparent; unlimited transparent, translucent, and opaque colors	Matte
WHITMAN PLASTICS CORP. 655 Summer St., Lynn, Mass.		Calendered	0.005 to 0.020	22	52	Unlimited transparent, translucent, and opaque colors	Polished

B&J can one of these high capacity grinders replace two or more of your present grinders

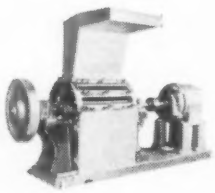
If your needs requre a grinding capacity of 500 pounds or more an hour, chances are, you've added capacity as it was needed — starting with one small grinder, adding other small grinders when needed to provide increased output. This may have been the easiest way at the time, but, is it the most efficient and economical *now?*

If your plant is like most, you can effect appreciable savings in production, maintenance and machine operating costs by replacing two or more of your old, smaller machines with one of the B & J high capacity grinders shown here. One of these grinders is designed to best meet your production requirements for the type of material you use.

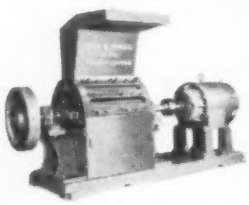
Tell us your requirements or send samples of your material for grinding in our testing laboratory — we will recommend the best machine for you. Or, write for brochure describing our many different size machines.



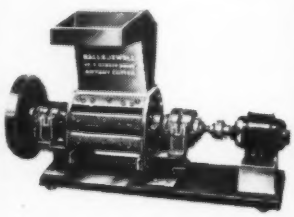
No. ½ Heavy Duty — 6" x 20" throat opening. 15 H. P. motor. Features large breaker knife for faster cutting of large area rejects, purges and accumulated scrap. Capacity up to 500 pounds an hour.



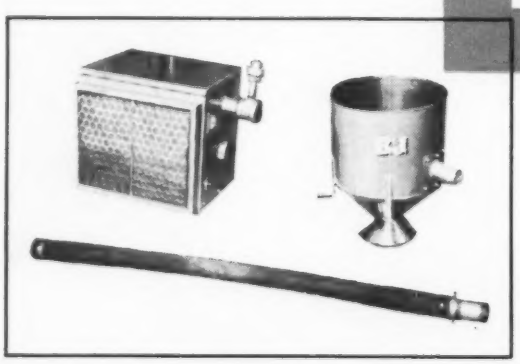
No. 1 — 7" x 24" throat opening. 10 or 15 H. P. motor. For accumulated runners, sprues, slabs, rejects, bleeder scrap, etc. Capacity up to 750 pounds an hour.



No. 1½ — 8" x 26" throat opening. 15, 20 or 25 H. P. motor. For tough scrap, purges, lumps, virgin slab, large area rejects, etc. Capacity up to 1200 pounds an hour.



No. 2 — 3 models, 28" x 10", 18" x 10", or 12" x 10" throat openings. 25 to 60 H. P. motor. For virgin slab, large lumps, purges and large rejects and bleeder scrap. Capacity up to 1800 pounds an hour.



B & J HEATER-DRYER
(hopper attachment)

CONDITIONS, DRIES, PRE-HEATS MATERIAL
INCREASES PRODUCTION

Installed on top of any injection molding machine, or any off-the-floor location, the B & J Heater-Dryer eliminates rejects caused by moisture, by removing moisture from the material. You save time and labor, while getting more "full shots". Write for brochure today.

Remember, Ball & Jewell are the Leaders in Large as well as Small Grinders

BALL & JEWELL, INC.

22 FRANKLIN STREET EVergreen 9-6580 BROOKLYN 22, NEW YORK

MEMO: To our Advertising Agency
SUBJECT: Could those ads be about *us*?

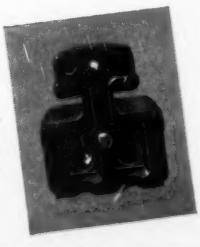
Let's face it, fellows! Haven't you been gilding us lilies a bit?

We sweat bullets, sometimes, over moulds. Sometimes we balance off imponderables like material variations, temperature changes, atmospheric conditions and the rest—and get the right answer quick. Sometimes, not so quick. For this moulding business is still almost as much art as science, and there isn't any such thing as heavy-duty, all-weather, push-button perfection.

Admittedly, good equipment and experience like ours means a break for the customer. Which probably explains why we have on our books right now hundreds of customers, big and small, who've stuck with us as principal suppliers for ten years and over.

How about using that fact for an ad —instead of a picture of a plastics application which "Only could be properly produced by K-K, with its mighty resources and unparalleled know-how"?

Try it. Let's see if one or two good new customers don't call us!



Twist-out plug moulded for Bulldog Electric Products —a 10-year-plus K-K customer

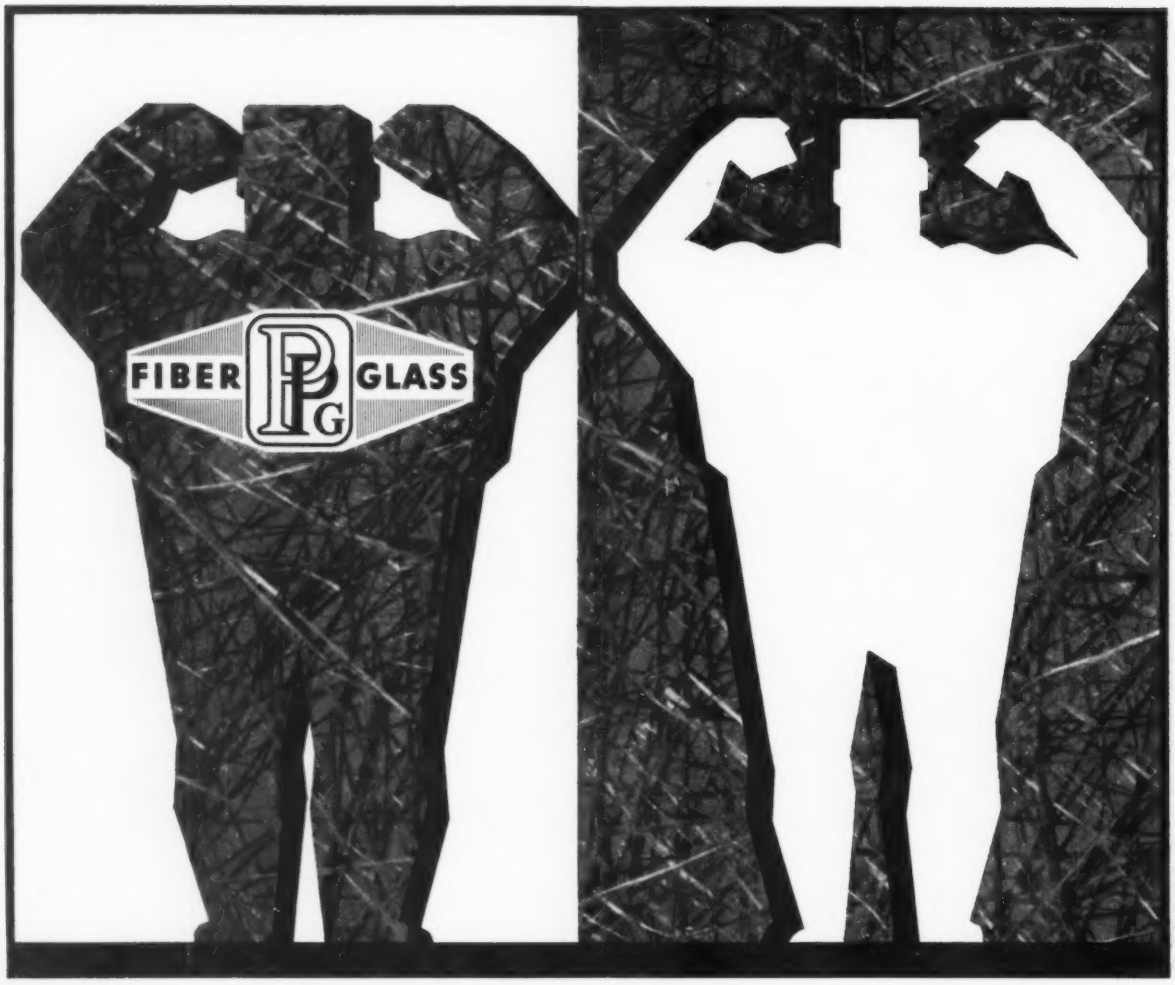
KURZ-KASCH

Specialists in Thermo-Setting Plastics for 37 years

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, *Mt. Vernon MO 4-4866* • Rochester, *Hillside 4352* • Chicago, *Merrimac 7-1830* • Detroit, *Trinity 3-8200* • Philadelphia, *Hilltop 6-6472* • Dallas, *Logan 5234* • Los Angeles, *Richmond 7-5384* • St. Louis, *Delmar 9577* • Atlanta, *Elgin 0870* • Toronto, *Riverdale 3511*.

EXPORT OFFICE: 89 Broad St., New York City, *Bowling Green 9-7751*.



Your partner to help make good plastic moldings better!

For today's business, development of plastics moldings that are safer, lighter, stronger is a necessity. And, PPG Fiber Glass can really help you realize such improvements the "fiber glass reinforcing" way.

As molders, you know your molding problems best—but the local PPG Fiber Glass representative can be of invaluable service in recommending types and sizes of PPG reinforcement that you should use in any particular molding job.

Over 70 years of glass-making experience stand behind Pittsburgh Fiber Glass. This experience has meant a new high quality in Roving, Chopped Strands and Yarns bearing the Pittsburgh trademark.

Why not prove to yourself how Pittsburgh Fiber Glass can help to make your products better. Simply contact our executive offices or our district sales offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

Write our executive offices today for the new folder describing Pittsburgh Fiber Glass reinforcements.

FIBER PPG GLASS **PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS**

PITTSBURGH PLATE GLASS COMPANY

GAIR can help PROMOTE YOUR PRODUCT with eye-appeal PRINTING

Attractively printed Gair shipping boxes double as sales promotion aids—giving prominent display to brand names while traveling through the channels of distribution. Prospects along the way—from factory to warehouse, to store, to home—see these sales messages.

Look around. You'll notice that products from paints to peanuts, from soaps to stoves carry colorful, well-printed identification on their shipping boxes.

What about yours?

Remember, this traveling display is economical. You own the "billboards". . . for just the cost of plates and printing you add a strong link to your promotional chain.

To learn how your shipping box can double as a sales promotion aid, check with the Gair plant nearest you. Learn, too, how Gair's assured supply source, engineering ability and delivery service help give you the best in corrugated or solid fibre shipping boxes.

Ask for a copy of the Shipping Case Handbook.

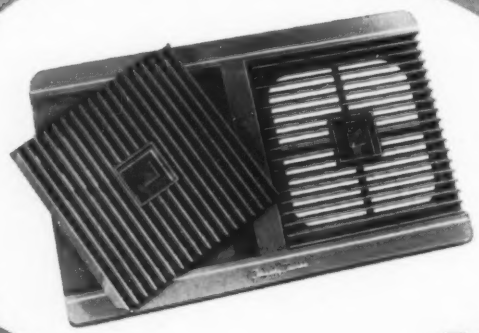
CAMBRIDGE, MASS. • CLEVELAND, OHIO • HOLYOKE, MASS. • LOS ANGELES, CAL. • MARTINSVILLE, VA.
NO. TONAWANDA, N. Y. • PHILADELPHIA, PA. • PORTLAND, CONN. • RICHMOND, VA. • SYRACUSE, N. Y. • TETERBORO, N. J.

GAIR

SHIPPING CONTAINERS
FOLDING CARTONS
PAPERBOARD

ROBERT GAIR COMPANY, INC. • 155 EAST 44th STREET • NEW YORK 17

for **TOUGH** molding jobs . . .



METASAP® STEARATES

deliver easier mold release

FOR molding those intricate shapes, for deep drawing, or for larger-than-average pieces, the tested way to easy ejection is to use the right Metasap Stearate in your molding compound.

There are two ways to use these Stearates. Metasap Zinc or Calcium Stearates can be incorporated into the molding compound itself, or simply dusted on the molding surface. Either way, you get improved lubrication at lower ejection pressures. You step up your output, get fewer rejects, and better finished products. Your molds last longer too.

So specify compounds containing Metasap Stearates or incorporate them directly into your own molding compound. Metasap Technical Service is prepared to help you find the materials and mixing procedures best fitted to your production methods.

. . . and to produce economical plastigels

Metasap offers a complete line of quality Stearates, effective as thickening agents. We'll be glad to make available to you free testing samples of Magnesium, Barium, Calcium, or Aluminum Stearates. Ask for yours today.

REG. U. S. PAT. OFF.

METASAP CHEMICAL COMPANY

METASAP CHEMICAL COMPANY, Harrison, N. J.

Chicago • Boston • Cedartown, Ga. • Richmond, Calif.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

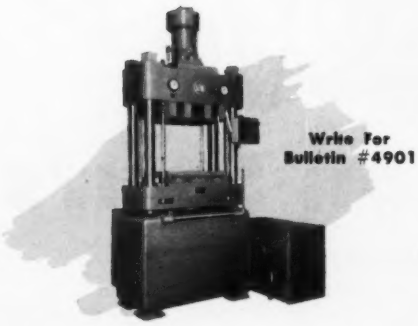
Famous TOASTMASTER TOASTER *Line*

MOLDED WITH

H-P-Ms

● The presses that mold plastics for the famous Toastmaster Toasters are just as modern as the end product. High-speed H-P-M plunger transfer presses, combined with high frequency heating, produce these intricate parts on-a 70 second cycle!

You can't beat an H-P-M for speed and dependability . . . it's rugged and equipped with H-P-M's trouble-free, self-contained hydraulic operating system.
Investigate what H-P-M plunger molding will do for you! Write today!



Write For Bulletin #4901

HPM THE HYDRAULIC PRESS MFG. CO.

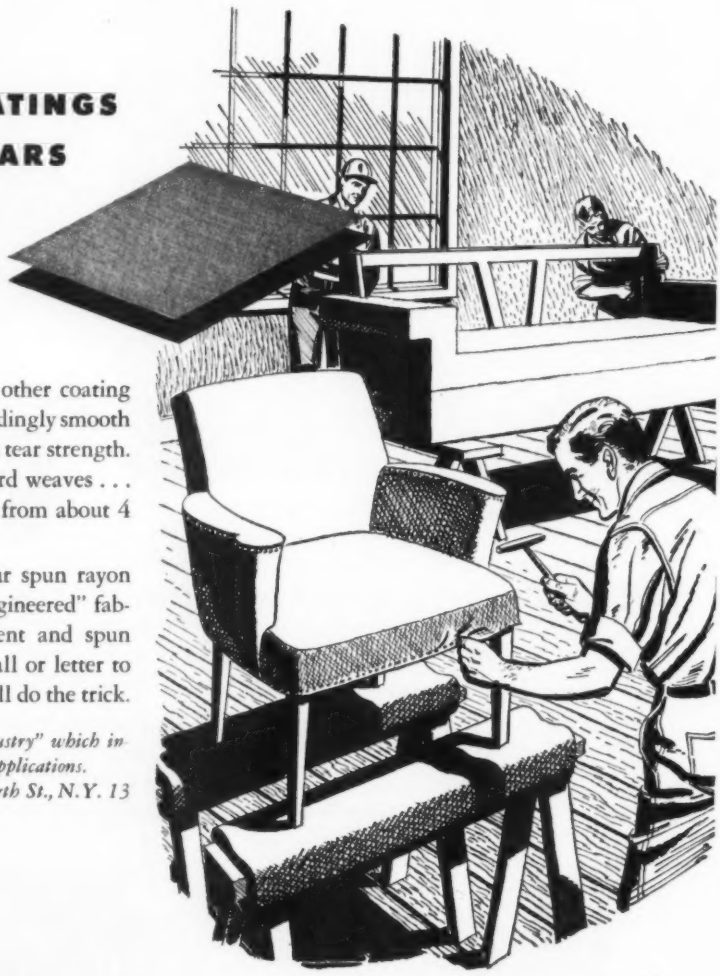
1010 Marion Road, Mount Gilead, Ohio, U. S. A.

Presses For Every Pressure Processing Application

The uniformly high quality of Wellington Sears drills has established them in a wide variety of large-volume coating applications.

Smooth weave surface, high tear resistance, and tensile strength are important coating features of Wellington Sears sateen.

YOU GET SMOOTH COATINGS WITH WELLINGTON SEARS SPUN RAYON FABRIC



Already established as a solid favorite in the upholstery field, Wellington Sears spun rayon fabric is developing rapidly in other coating applications. It meets the need for an outstandingly smooth and clean coating surface that is also high in tear strength. The fabric is available in a range of standard weaves . . . widths up to 60 inches . . . and in weights from about 4 to 10 ounces per square yard.

Why not let us tell you more about our spun rayon fabric and other Wellington Sears "fiber-engineered" fabrics. These include filament rayon; filament and spun nylon, Orlon*, Dacron**; spun dynel. A call or letter to your nearest Wellington Sears sales office will do the trick.

Write for a free copy of "Modern Textiles For Industry" which includes pertinent information on fabric-and-plastic applications. Address: Wellington Sears Co., Dept. J-3, 65 Worth St., N.Y. 13

*DuPont's trademark for its acrylic fiber.
**DuPont's trademark for its polyester fiber.

Superior Fabrics for Coating and Laminating

- Single filling ducks
- Army ducks
- Single and plied-yarn chafers
- Special ducks
- Sateens
- Twills
- Broken twills
- Drills
- Sheetings
- Nylon, rayon and other synthetics
- Lantuck non-woven fabrics

Wellington Sears

A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

Offices In: Atlanta • Boston • Chicago • Detroit • Los Angeles • New Orleans • Philadelphia • San Francisco • St. Louis

The Dove and the Ant

A thirsty Ant went to drink in a bubbling brook, but the current was so strong that it snatched her away. A Dove, pitying her distress, broke a branch from a tree and let it fall into the water, by means of which the Ant saved herself and got ashore. Not long after, a Fowler, having a design upon the Dove, planted his nets without the bird's observing what he was doing. The Ant, perceiving him just as he was about to catch the Dove, bit him on the heel and startled him so that the Dove took the alarm and flew away.

One good turn deserves another. —Aesop

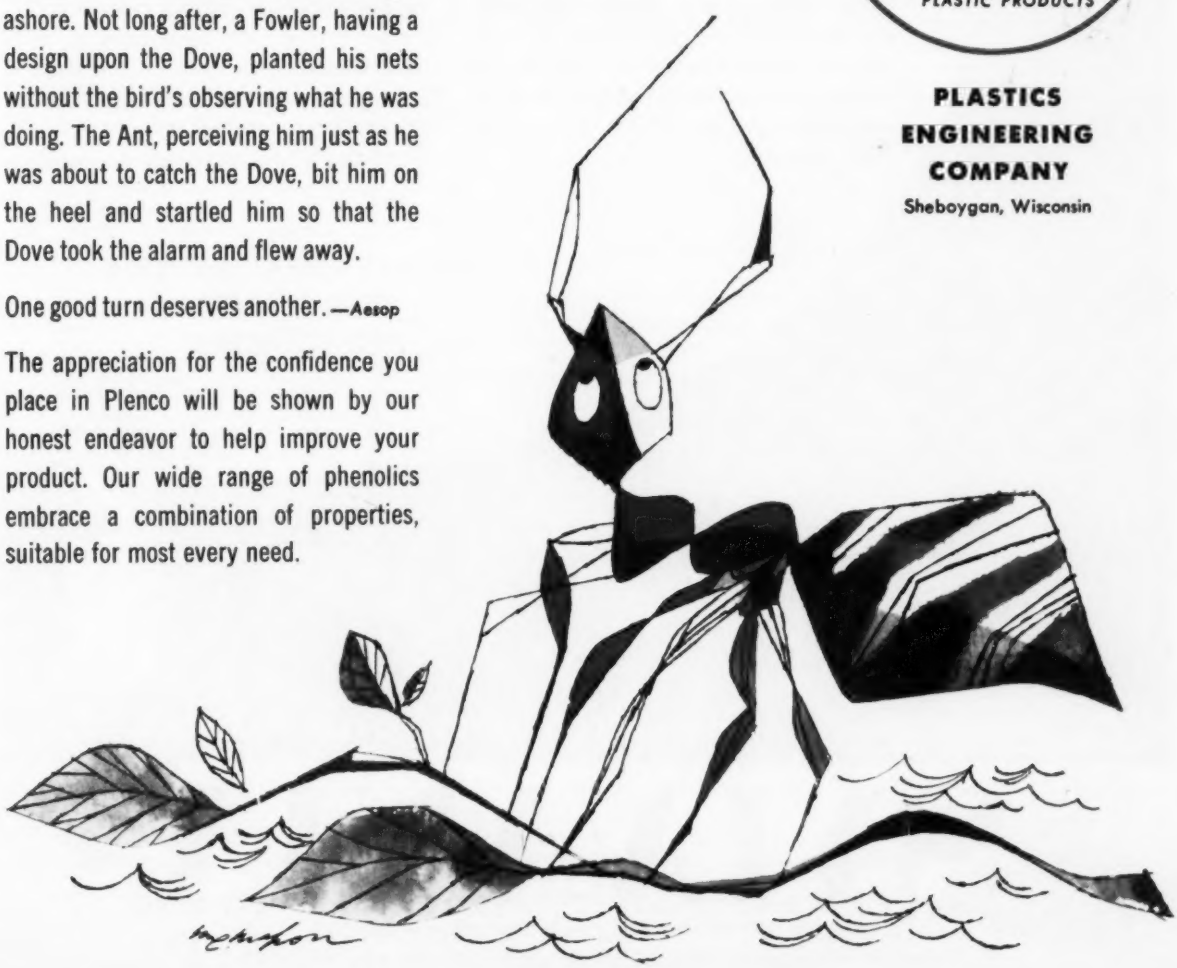
The appreciation for the confidence you place in Plenco will be shown by our honest endeavor to help improve your product. Our wide range of phenolics embrace a combination of properties, suitable for most every need.

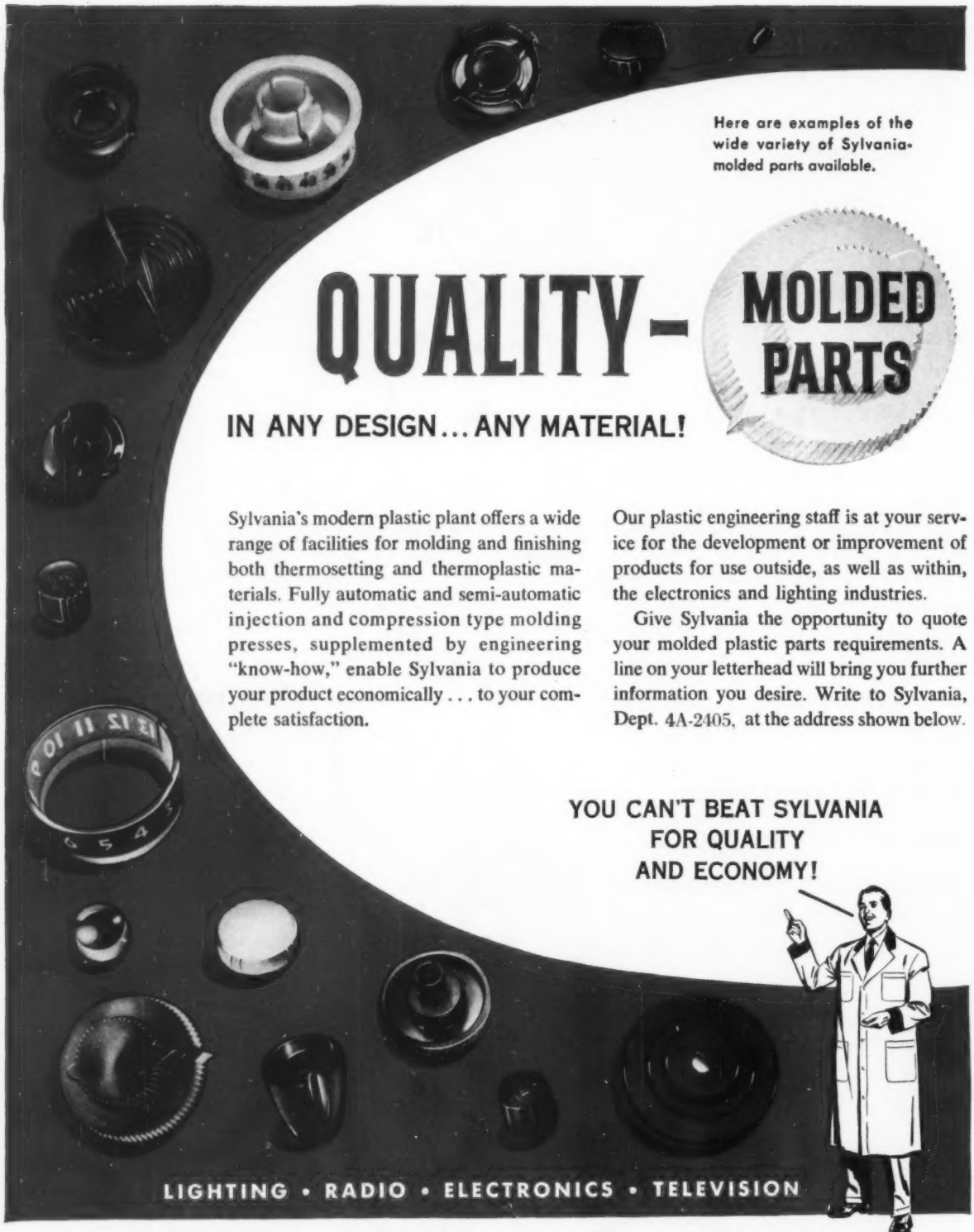
PLEN[illegible]ENOLICS

FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin





Here are examples of the wide variety of Sylvania-molded parts available.

QUALITY— MOLDED PARTS

IN ANY DESIGN... ANY MATERIAL!

Sylvania's modern plastic plant offers a wide range of facilities for molding and finishing both thermosetting and thermoplastic materials. Fully automatic and semi-automatic injection and compression type molding presses, supplemented by engineering "know-how," enable Sylvania to produce your product economically . . . to your complete satisfaction.

Our plastic engineering staff is at your service for the development or improvement of products for use outside, as well as within, the electronics and lighting industries.

Give Sylvania the opportunity to quote your molded plastic parts requirements. A line on your letterhead will bring you further information you desire. Write to Sylvania, Dept. 4A-2405, at the address shown below.

YOU CAN'T BEAT SYLVANIA FOR QUALITY AND ECONOMY!

LIGHTING • RADIO • ELECTRONICS • TELEVISION

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catherine St., Montreal, P. Q.

Presenting

NOW . . . get PERMANENT FIRE RESISTANCE WITH NO LOSS IN HEAT RESISTANCE

TYPICAL PROPERTIES

- Weight loss of castings:
  After 168 hrs. at 392°F 2-3%
  After 720 hrs. at 392°F ... 13-15%
- Flexural strength retention of glass cloth laminates:
  After 168 hrs. at 392°F .. up to 90%
  After 720 hrs. water immersion 92%
- Shrinkage during curing.....5%
- ASTM heat distortion point of castings ..... 212-220°F
- Electrical properties of castings at 10^9 cycles:
  Dielectric constant 2.85
  Power factor ..... .00575
  Loss factor ..... .0164

FOR COMPLETE INFORMATION on HETRON resins, send today for technical data sheets listing properties of the liquid resins, cured unfilled resins, and glass cloth laminates. Includes general handling and curing recommendations, and other useful information.

In HETRON, a new family of self-extinguishing resins, you will find *in full measure* all the properties a good fire-resistant polyester should have.

Heat resistance, in particular, is outstanding. Castings aged at 200°C lost only 2% of weight in seven days (as compared with 10% or more for standard non-fire-resistant resins, and up to 20% for ordinary fire-resistant resins).

Glass cloth laminates aged at 200°C for seven days retained up to 90% of their room temperature flexural strength. Fire resistance was virtually unchanged in the same period.

HETRON resins are self-extinguishing even without the use of additives, because they contain 30% chemically-bound chlorine. At the same time, they are clear and stable. Where even higher fire resistance is desired, addition of 5% antimony trioxide results in laminates that will not support a flame for one second, even after five repeated applications of a Bunsen flame.

Transmission of water vapor through HETRON resins is very low, compared to standard resins—so low that it is difficult to measure accurately. Absorption of water is also lower. For these reasons, electrical properties of the resins are much less affected by long exposure to high humidities and elevated temperatures than ordinary polyesters.

Shrinkage-on-cure of less than 5% by volume, and little or no air inhibition, are important advantages of the new resins. Resistance to acids is better than that of standard resins. Heat distortion temperatures are better than with many standard polyesters.

HETRON resins are light-colored, transparent viscous liquids. At present, they are available in drum quantities.

The facilities of our laboratories are available to cooperate with you in the application of HETRON polyester resins.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

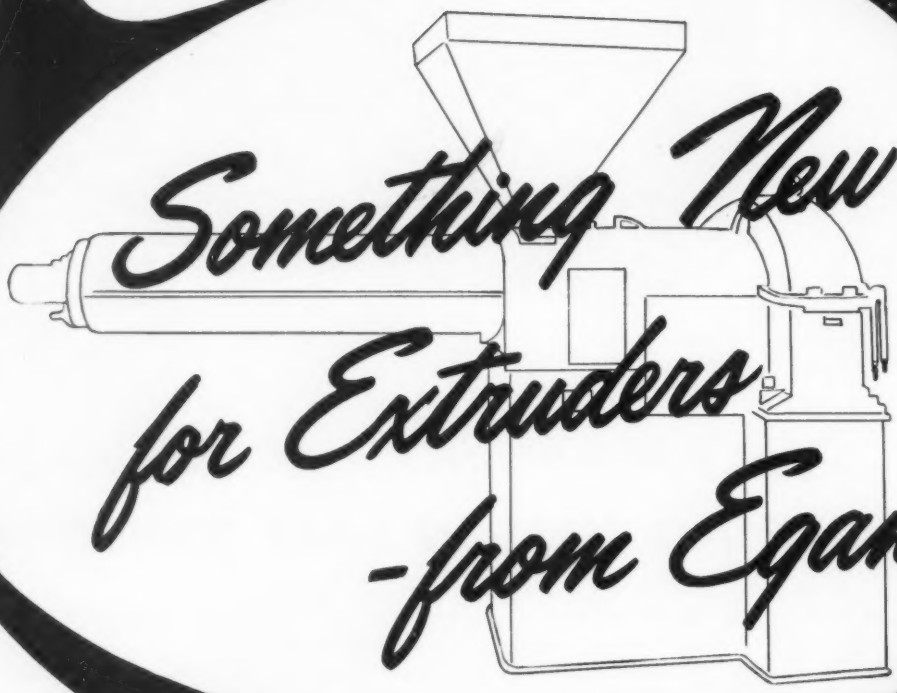
18-47TH STREET, NIAGARA FALLS, NEW YORK

NIAGARA FALLS • TACOMA • MONTAGUE, MICH. • NEW YORK • CHICAGO • LOS ANGELES

HOOKER CHEMICALS

Egan

Something New for Extruders -from Egan



See Our Exhibit at

National Plastics Exposition

in Cleveland June 7-10

Write for details or invite our representative to call

FRANK W. EGAN & COMPANY

Designers and Builders of Machinery
for the Paper Converting and Plastics Industries

Bound Brook, New Jersey

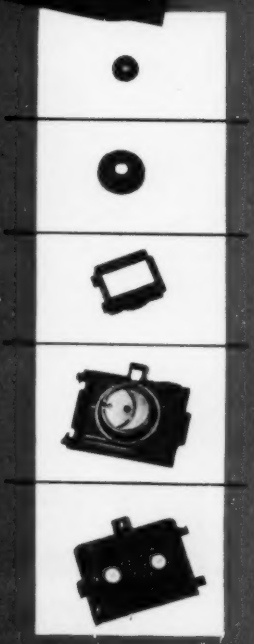
Cable Address "EGANCO"—BOUNDBROOK, N.J.

BALANCING

COST and QUALITY

custom injection molding by

Ideal



KEEPING A STRICT EYE on costs and still producing a camera that really does a nice job of taking pictures requires a heap of engineering ingenuity and production know-how.

Proof that Ideal Plastics is equal to the challenge is this low-costs to a minimum. That holds true for moldmaking, for mold-Long Island City 1, N.Y. The unit is molded of shiny black styrene in five parts which are later assembled with a lens, a shutter and other components.

Ideal is a master of all the tricks and shortcuts for holding costs to a minimum. That holds true for moldmaking, for molding and for fabricating.

Whether your product is a low-priced item demanding inexpensive mass-producing, or a higher grade of merchandise where quality considerations are most important, Ideal is set up to injection mold it. Naturally, we do any or all of your assembling, finishing and decorating.

For full information on Ideal's outstanding custom injection molding service contact A. C. Maxwell, Vice Pres. in Charge of Sales. IDEAL PLASTICS CORPORATION, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000.

Better Molded Plastics **Ideal** *for Industry & Home*

Here comes the "Dutch Boy" with a new idea....

THE NEW "DUTCH BOY" PLASTICIZERS

Three Double-Duty Primary Plasticizers

PRODUCT	USED FOR—
NL F-41	Outstanding low temperature flexibility Good low volatility
NL F-31	Very good low temperature flexibility Good low volatility
NL F-21	Good low temperature flexibility Outstanding low volatility

Four High Purity Standard Plasticizers

NL C-20 (Di-2-ethylhexyl Sebacate)
NL A-10 (Dibutyl Phthalate)
NL A-20 (Di-2-ethylhexyl Phthalate)
NL A-30 (Di-isooctyl Phthalate)

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double-duty plasticizers!

***FIRST** to give you close control of both low temperature flexibility and low volatility at the same time.*

Look what the "Dutch Boy" is bringing you now!

Three unique new double-duty vinyl plasticizers . . . each factory pre-balanced to give you both low temperature flexibility and low volatility in a pre-determined ratio suitable to a wide range of vinyl end products:

"Dutch Boy" Plasticizer

NL F-41, to give vinyl chloride polymers and other resins *outstanding low temperature flexibility* balanced with *good low volatility*. It also imparts excellent hand and drape, good heat and light stability, low water extraction. Its high plasticizing and solvating efficiency simplifies processing.

"Dutch Boy" Plasticizer

NL F-31, a new primary plasticizer to give polyvinyl chloride formulations *very good low temperature flexibility* and *good low volatility*. NL F-31 is the only commercial plasticizer that gives you both properties at moderate cost—without compromising efficiency, processing characteristics or physical properties.

"Dutch Boy" Plasticizer

NL F-21 is unequalled for providing vinyl resins with *outstanding low volatility* while maintaining *good low temperature flexibility*, stability and hand. When used at 20-50% of the plasticizer mix, it reduces volatilization losses during processing and increases product service life.

All three of the "Dutch Boy" double-duty Plasticizers give processors of vinyl film and sheeting, extruded products, plastisols and organosols the opportunity to formulate lower-cost, easier-to-process vinyl products...without sacrifice of quality characteristics.

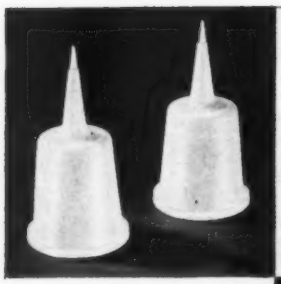
The "Dutch Boy" Plasticizer Line also includes:

Four exceptionally pure standard-type plasticizers that will give you excellent results in your present formulations. Together with the three "Dutch Boy" double-duty Plasticizers, they are made to conform to the same high "Dutch Boy" standards that have always characterized "Dutch Boy" Stabilizers.

National Lead will be glad to send you detailed technical data on any or all of the seven "Dutch Boy" Plasticizers . . . or the twelve "Dutch Boy" Stabilizers. Just write...on your letterhead, please.

A LEADER IN STABILIZERS, TOO

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat, light, weathering, in opaque stocks including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears
CALSTAR (Calcium Stearate)	Where non-toxicity and lubricity are required
LEADSTAR (Lead Stearate)	As lubricant and co-stabilizer



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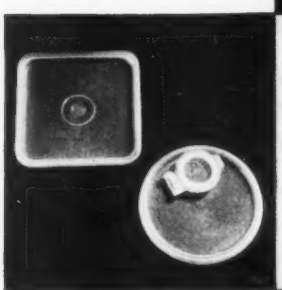

Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Per Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

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TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

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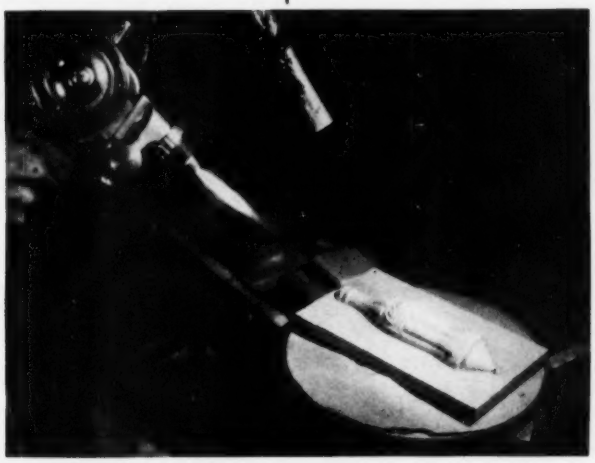
molds made in minutes

by fast, low-cost metallizing process

For low-pressure, vacuum, slush and lay-up molding.

Metallizing, the spraying of molten metal, is now being used for the production of molds for low-pressure, vacuum, slush and lay-up processes, in a wide range of mold sizes—some lay-up types as much as 30 feet long. These metal molds are made quickly, at low cost; masters may be of metal, cloth, wood, plastic, glass, or even wax. Finest detail is retained and mold life is practically indefinite. Part spoilage, "break-out" and patching or other maintenance on lay-up molds are eliminated; improved heat transfer, better curing, assure void-free parts.



Metallizing gun building up metal mold directly on plaster master

Finished mold. Note fine detail. Spraying time 28 minutes.

MODERN PLASTICS article describes method

The article, "SPRAYED METAL MOLDS," by *Dr. Walter Brenner* and *Leopold Hase*, of Brooklyn Polytechnic Institute, which appeared in the September MODERN PLASTICS, described the process in detail. We will be happy to send you a reprint of this article on request. Use the handy coupon.

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"Here, sir, are your moldings on a Boontonware platter"

The impeccable attire and reserved manners of Boonton, the perfect plastics butler, mask the sweat and toil he's gone through.

When he glides into your receiving department laden with fine plastics moldings there won't even be a whisper about. . . .

(1) the sleepless nights Boonton's spent doping out a finishing method that would cut your costs
(2) the juggling he's done to make sure the right machines for molding your parts were free when needed
(3) the eye-straining inspection he's given each and every piece he brings you
(4) the mad dash he's made to your door to meet your requested delivery

Boonton is never reluctant to make a quiet suggestion or two that will help things work better; nor does he hang back when called on to select a suitable material for a job.

Of course, there are flashier butlers than Boonton—butlers who will swear they can deliver the moon; butlers who say they can mix superior extra-dry martinis; butlers who use nothing but radio-active molding powders; butlers who can show you the right way to use a niblick.

But when it's a question of providing good moldings at non-budget-wrecking prices, the butler many soundly-managed plastics users prefer to have serve them is Boonton.

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BOONTON, NEW JERSEY

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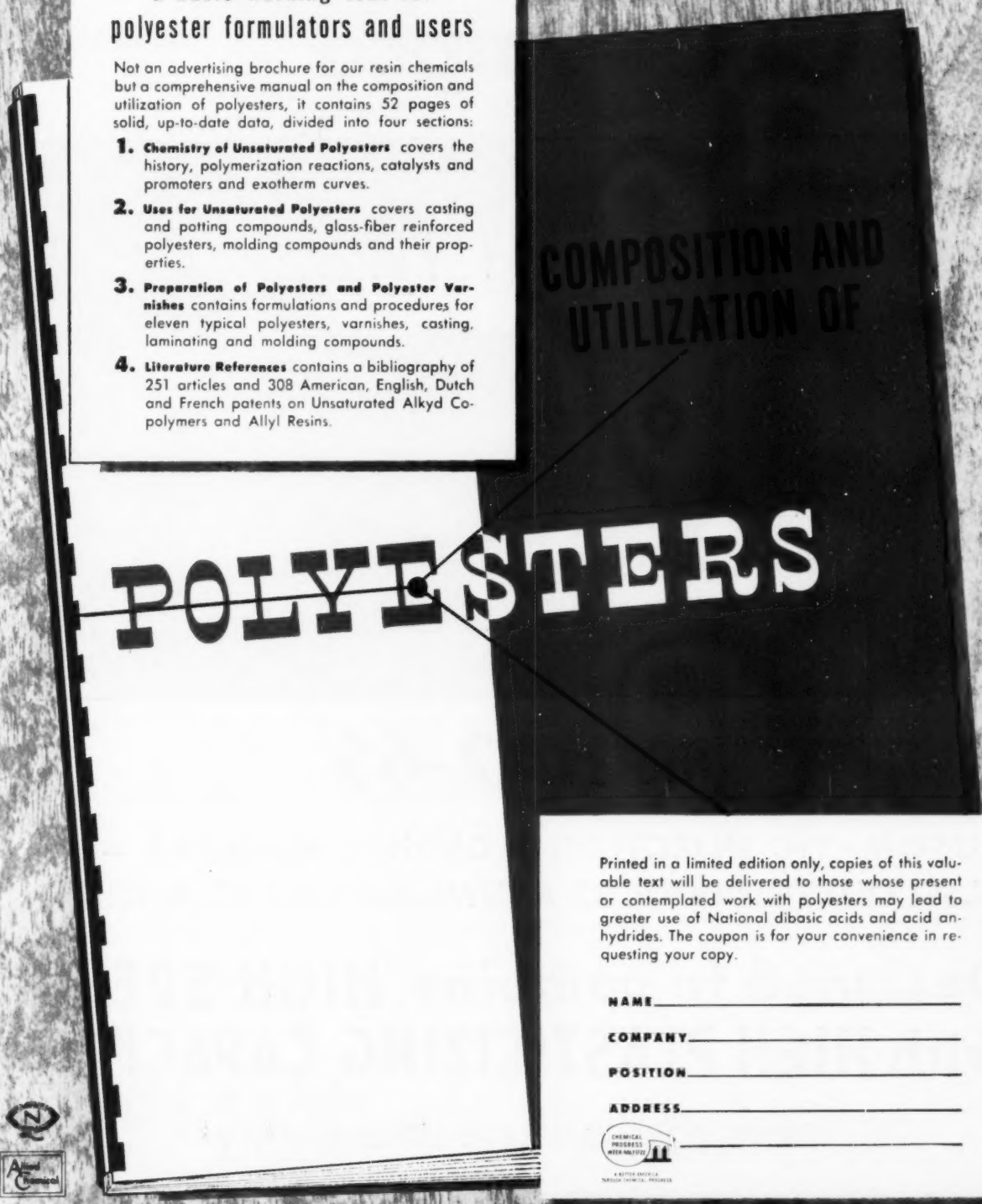
a basic working text for polyester formulators and users

Not an advertising brochure for our resin chemicals but a comprehensive manual on the composition and utilization of polyesters, it contains 52 pages of solid, up-to-date data, divided into four sections:

1. **Chemistry of Unsaturated Polyesters** covers the history, polymerization reactions, catalysts and promoters and exotherm curves.
2. **Uses for Unsaturated Polyesters** covers casting and potting compounds, glass-fiber reinforced polyesters, molding compounds and their properties.
3. **Preparation of Polyesters and Polyester Varnishes** contains formulations and procedures for eleven typical polyesters, varnishes, casting, laminating and molding compounds.
4. **Literature References** contains a bibliography of 251 articles and 308 American, English, Dutch and French patents on Unsaturated Alkyd Copolymers and Allyl Resins.



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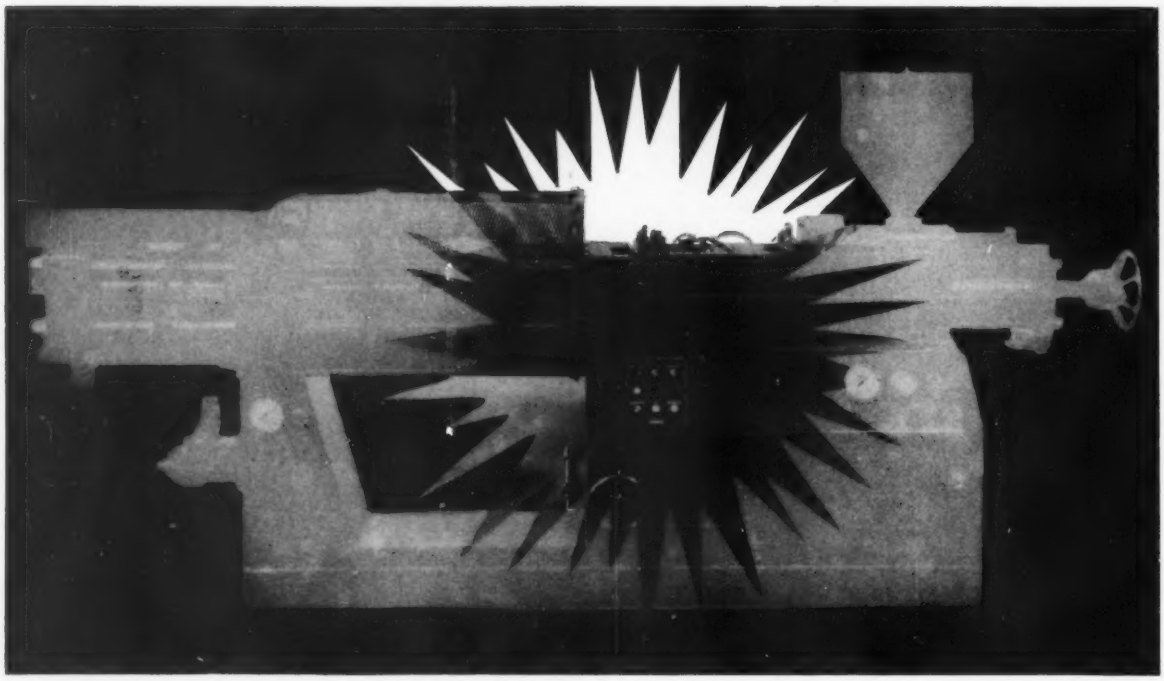

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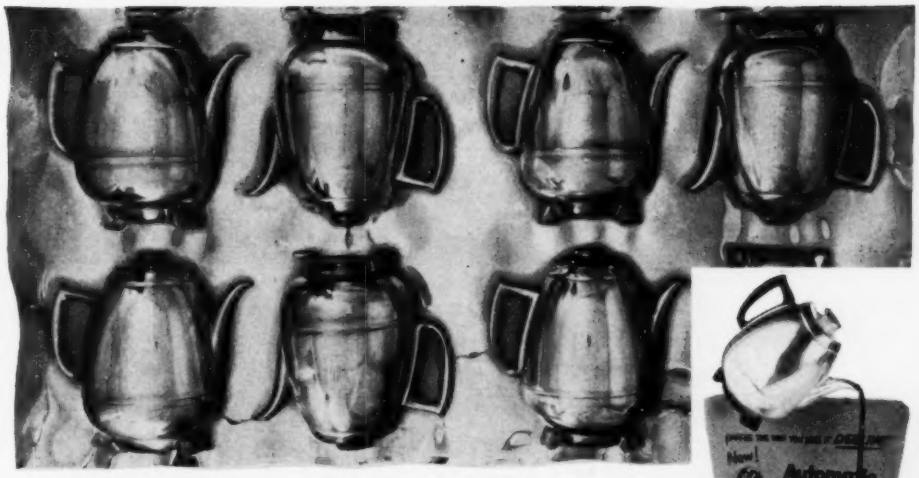

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Eye-appeal is buy-appeal. That is why Gomar silver butyrate was chosen for this realistic replica of a General Electric coffee maker. (Display produced by Kindred-MacLean; forming of coffee pots by Vacu-Form Corp. of America.) Only a thermoplastic with the exceptional properties of this material assures constant brilliance in mass-production vacuum forming, eliminating the costly two-phase procedure of first molding objects from non-metallic stock and then individually plating the pieces.

Leading display firms and promotion-minded companies recognize the unique advantages of Gomar metallized plastics, and the constantly good results they provide in vacuum forming and many other applications. That is why more and more manufacturers and advertisers are turning to these materials to give "definite dazzle" to three-dimensional signs, posters, packages, sales kits, trade marks, bumper strips, seasonal and holiday novelties, toys, ornaments, costume jewelry, and premiums.

Gomarized Glitter

The colors of Gomar butyrate are securely impregnated by the exclusive Gomarizing process. There is no surface coating to rub off, peel, or chip. The metallic effect will not burn off and leave a dull finish. Light-fast and heat-resistant dyes are "buried" deep inside each sheet. Inks adhere as readily as to clear unprocessed sheets, with perfect register on preprinted designs.

Ease • Economy

The savings you gain in the purchase prices of Gomar thermoplastic materials are multiplied by the savings obtained through production efficiencies. All Gomar metallized films and sheets —butyrate, styrene, acetate—are tough and durable. They can be laminated, pleated, cemented, painted, sprayed, silk screened, printed, lithographed, stencilled, cut, scored, and stitched.

Choice • Convenience

Gomar metallic plastics offer a wide selection — smooth finishes, patterns, embossed effects, a choice of pearlescence or iridescence. They are quickly delivered from stock in standard rolls 21 inches wide and up to 1,000 feet long, also slit or sheeted to specified size. Butyrate comes in .010, .015, .020, and .030 gauge—styrene in .0065—acetate in .003, .005, .0075, .010, .015.

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FREE!

and it's yours on request.

Swatches illustrating 18 brilliant colors and a variety of eye-catching effects are on the Gomar color card that is yours for the asking. Working-size samples are also furnished without cost or obligation.

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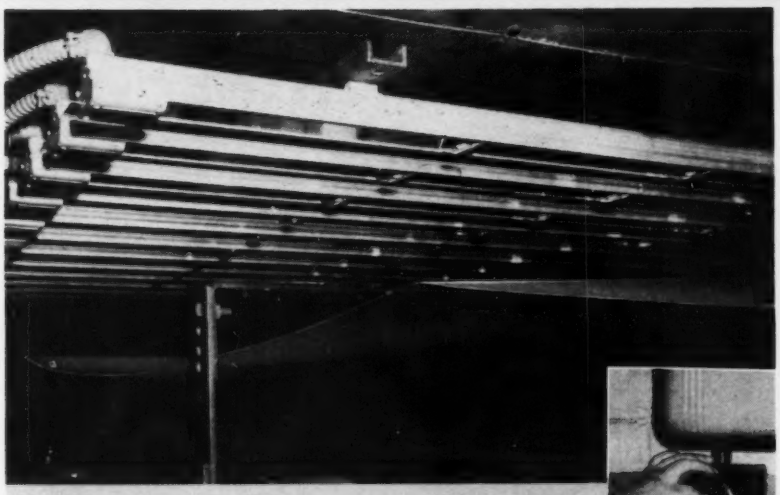
CHROMALOX Production Tips

PROFITABLE IDEAS FOR PLASTIC PROCESSING



$600 vs. $25,000—The *right* heat in the *right* place eliminated the need for an additional $25,000 embossing press! The job was done with eight standard 5-ft. Chromalox Far-Infrared Heaters (shown above) at a cost of less than $600. Vernier control adjusts radiation to match speed and material thickness. These high intensity units doubled embossing speed over the previous rate, take up little valuable space.

UNIFORM, HIGH INTENSITY HEAT AND PRECISE CONTROL RESULT IN HIGH SPEED VINYL FUSING AND EMBOSSING

Many manufacturers of vinyl films are fusing cast vinyl in as little as ten seconds at speeds up to 100 yards per minute! They are obtaining this high speed production without expensive equipment and high pressure steam. Instead they use all-metal Chromalox Electric Radiant Heaters which are economical in initial cost and easy to install, even in existing equipment. Too, they occupy very little floor space.

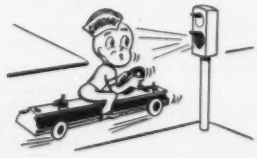
Basic reasons for the success of Chromalox Radiant Heaters in processing vinyls are the high heat intensity, uniformity and the precise control possible with these far-infrared generators.

In usual production procedure, plastisol film requires one minute at 400°F. to fuse in a convection type oven. When the film is processed in a Chromalox Radiant Oven fusing takes place in ten seconds. In the manufacture of organisol vinyl films Chromalox Radiant Heaters perform equally well.

When the vinyl films require embossing or laminating, Chromalox Radiant Heaters do a better job, more quickly in both unsupported and supported films. In film up to 20 mils thick, high-intensity Chromalox Radiant heaters are placed on only one side of the film.

Full details for fusing, embossing and laminating cast and calendered materials are contained in "The Vinyl Report" listed in the right column. Write for your copy.

BEING "COLOR BLIND" IS BIG HELP IN PROCESSING



White or black . . . transparent, translucent or opaque—it makes little difference when Chromalox radiant heat is on the job. That's because the radiation is in the invisible far-infrared wavelength that is absorbed with almost equal speed by all colors and surfaces. Even clear glass and plastics absorb far-infrared readily and heat up quickly.

CHROMALOX APPLICATION DATA TO HELP SOLVE YOUR PROBLEMS

☐ **DEHYDRATING VINYL SHEETS**—How production was increased and rejects reduced in laminating vinyl sheeting between two pieces of plate glass. *Report R-121.*

☐ **FUSING VINYL TO CHIP BOARD**—How Chromalox Electric Radiant Heaters improved quality, reduced heating time and increased production 500 per cent. *Report R-129.*

☐ **HEAT FOR EMBOSSING CHLORIDE PLASTIC WEB MATERIAL**—How twelve Chromalox RAD-6303 Radiant Heaters replaced an inefficient heat source and resulted in lower operating costs, better end-products, and increased production by 50 per cent. *Report 132.*

☐ **FUSING PLASTISOL COATING TO MAKE IMITATION LEATHER**—How preheating, fusing and embossing are performed in a continuous in-line operation using standard Chromalox Electric Radiant Heaters, input controllers and other components. Chromalox Heaters were installed with minimum expense and less time. *Report R-143.*

☐ **VINYL TREATING CLOTH**—Case history of Chromalox Radiant Heaters being used to fuse vinyl into cotton fabric for garden gloves. *Report L-1068.*

☐ **DOUBLING EMBOSSING CAPACITY**—How a $600 investment in Chromalox Electric Heaters saved an expenditure of about $25,000 for additional embossing equipment. *Report L-1086.*

☐ **VINYL REPORT**—An authoritative paper on the use of Chromalox Far-Infrared Radiant Heaters for fusing and embossing cast and calendered materials.

☐ **10 ADVANTAGES OF CHROMALOX FAR-INFRARED**—A quick digest of the pertinent facts which make "color blind" far-infrared the ideal heat source for plastics processors. *CS-604-B.*

☐ **101 WAYS TO APPLY ELECTRIC HEAT**—A 32-page handbook illustrating and describing approved methods of electrically heating processing equipment, liquids, air, etc.

☐ **ELECTRIC HEAT FOR BETTER PLASTICS PROCESSING**—Case studies of how Chromalox Electric Heaters of all types have been used for drying, forming, shaping, fusing, laminating, molding and other uses in the plastics field.

☐ **CHROMALOX CATALOG 50**—Complete application details, specifications and other data on over 15,000 types, sizes and ratings of Chromalox Electric Heaters.

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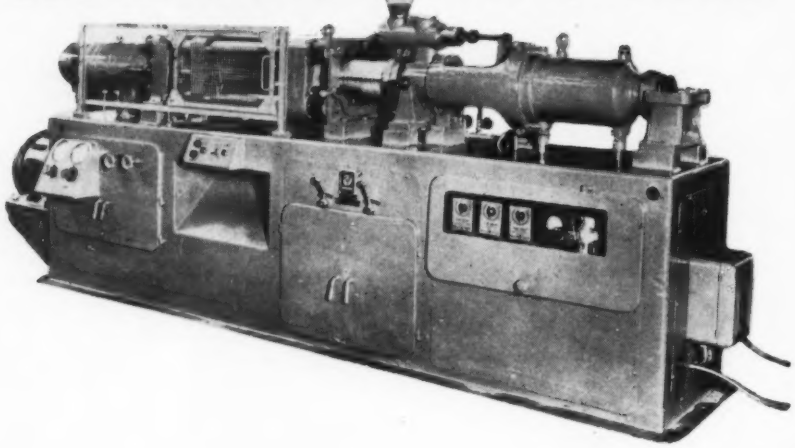

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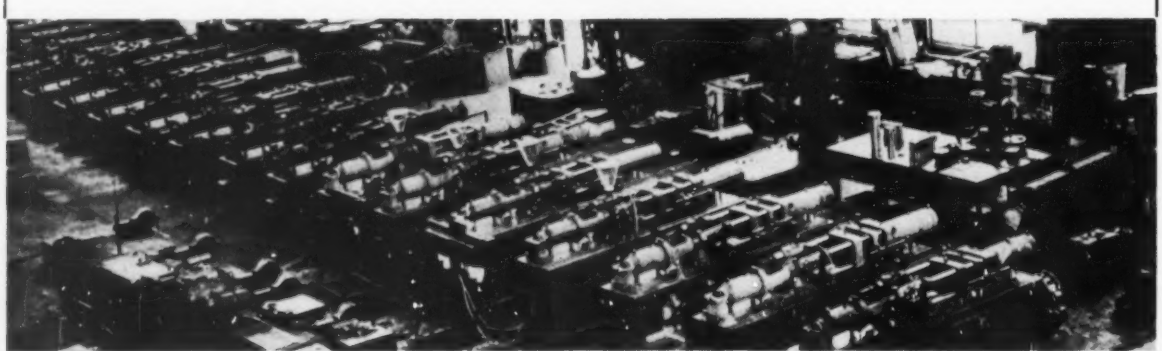

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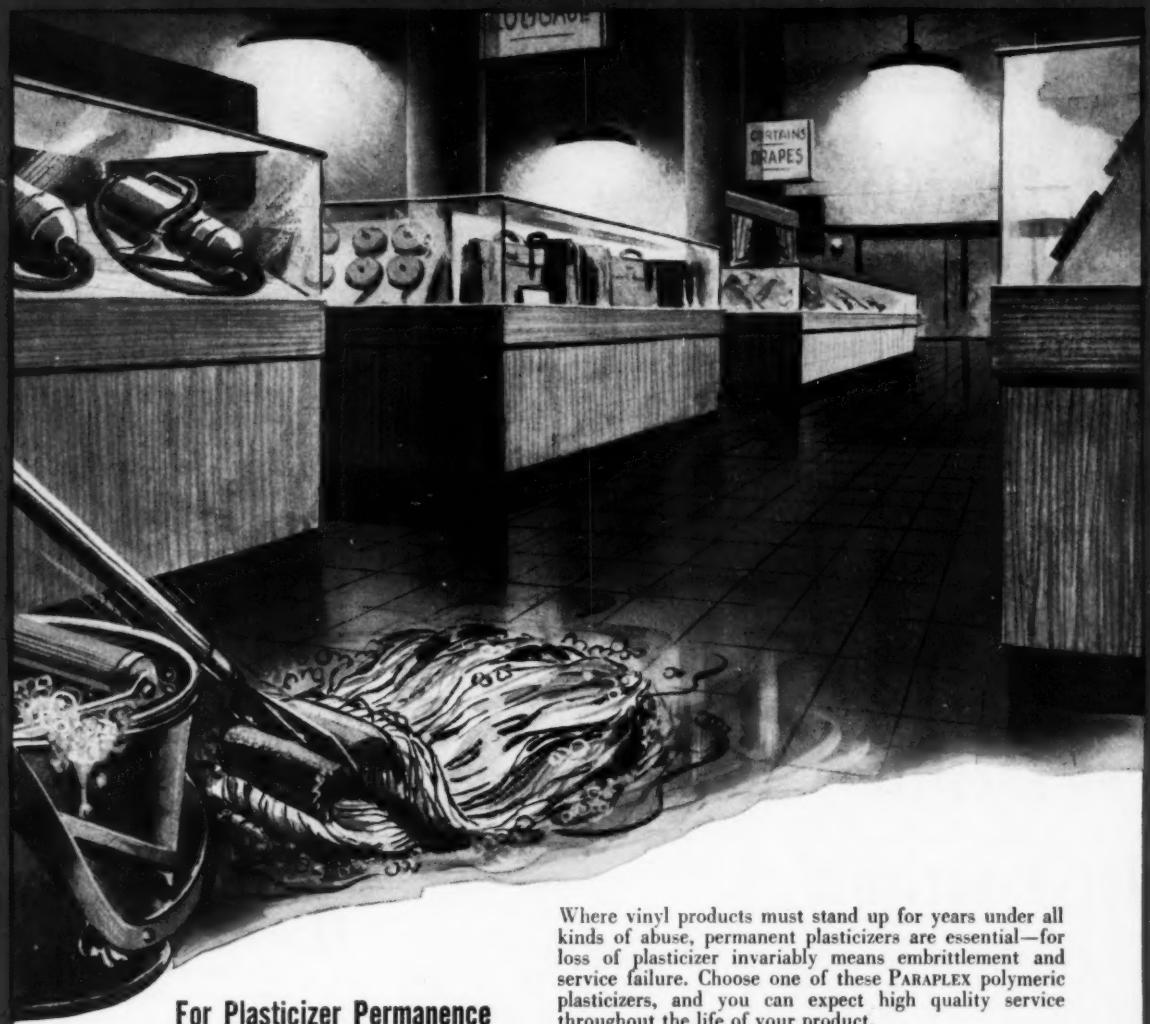

For Plasticizer Permanence ...where the traffic is tough—

PARAPLEX G-25

PARAPLEX G-40

PARAPLEX G-50

PARAPLEX G-53

Permanent Polymeric Plasticizers

Where vinyl products must stand up for years under all kinds of abuse, permanent plasticizers are essential—for loss of plasticizer invariably means embrittlement and service failure. Choose one of these PARAPLEX polymeric plasticizers, and you can expect high quality service throughout the life of your product.

PARAPLEX G-25 has long been recognized as the best plasticizer for all-around performance and long life. Non-volatile, non-migratory, highly resistant to extraction by water, oil, and gasoline.

PARAPLEX G-40 is a lower cost plasticizer, which has many of the properties of PARAPLEX G-25. It has better color, oil resistance, and resistance to migration into rubber.

PARAPLEX G-50 is the most economical of the permanent plasticizers, representing an excellent compromise between quality and cost. It is easy to handle, and is an excellent pigment grinding medium.

PARAPLEX G-53 is a highly permanent plasticizer, combining moderate price with resistance to extraction by oil, soap, or water, and freedom from migration, particularly into polystyrene.

PARAPLEX *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

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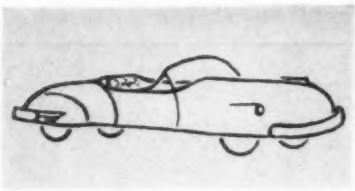
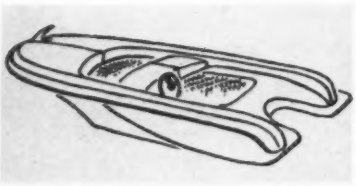
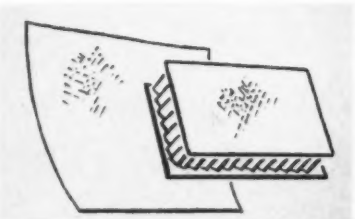
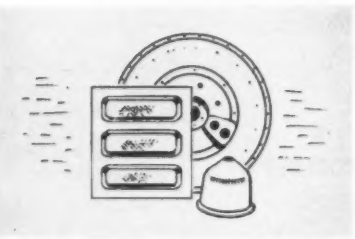
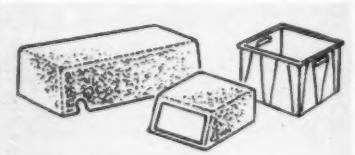










Winner **is the pioneer in the development and production of Fiberglas reinforced plastic parts.**

Winner **has one of the largest staffs of experienced engineers in the industry. We maintain one of the best equipped laboratories in the country and devote 80,000 square feet of floor space to Fiberglas reinforced plastic fabrication.**

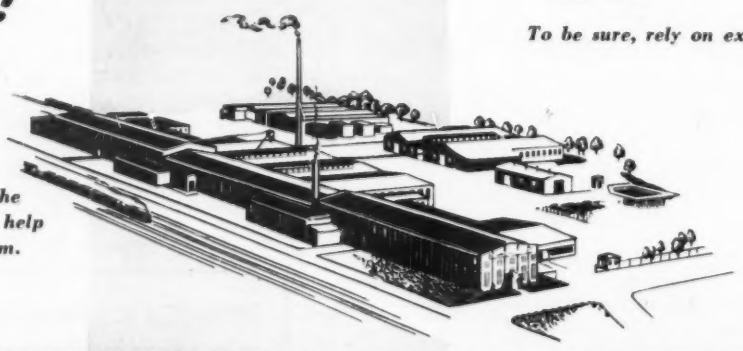
Winner **has molded a larger variety of parts — from a 3″ wave guide window to a 35′ boat hull.**

Winner **is one of the country's largest users of Fiberglas and resin molding materials.**

Winner **has pressure-bag molded more large parts and, in addition, has the best equipment for mass production of press-molded items.**

Winner **has a record of accomplishment in reinforced plastics unsurpassed by any other fabricator.**

To be sure, rely on experience!



Winner's technical staff has the know-how and experience to help solve your fabrication problem. Why not consult them?

Winner *MANUFACTURING COMPANY, Inc., P.O. BOX 399, TRENTON 3, NEW JERSEY*

Thermatron*

HIGH FREQUENCY EQUIPMENT FOR WELDING OF PLASTICS

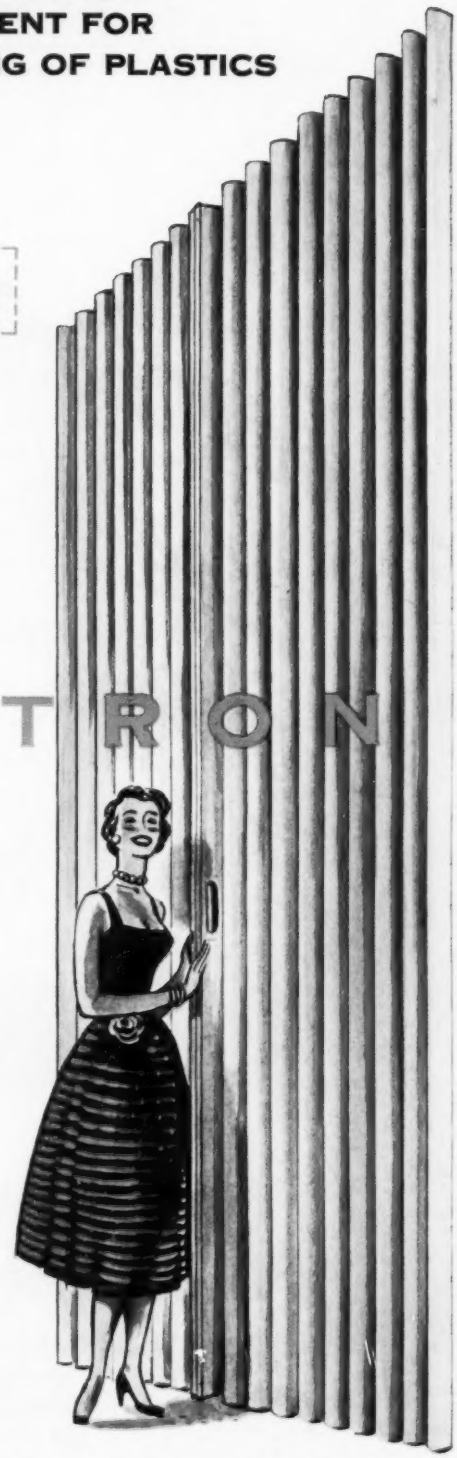
...Makes a long story SHORT!

THERMATRON electronic generators and presses make short work of those long plastic seams on such products as folding doors, 3D motion picture screens, industrial drapes, swim floats and air mattresses. Production time is shortened tremendously and durability is increased — For THERMATRON welds, doesn't stitch, producing one continuous seal that is actually stronger than the material itself.

THERMATRON

If your vinyl plastic product requires long seals (or short ones for that matter) THERMATRON engineers will gladly help you. We'll run tests on your own material and offer sound recommendations... all without obligation, of course. Write today for comprehensive bulletin 83.

Standard Thermatron models from ¼ KW to 6 KW weld vinyl from .002" up to .080", serving most requirements... but if you have a new and special need we can build to your specifications.



In Radio & Electronics Since 1922

Thermatron Division, RADIO RECEPTOR COMPANY, INC.
SALES DEPARTMENT: 251 WEST 19th STREET, NEW YORK 11, WAtkins 4-3633
Chicago Sales: 2753 West North Avenue
Los Angeles: Electroseal Plastics Co., 130 North Juanita Avenue
Factories in Brooklyn, N.Y.

*T. M. REG. U. S. PAT. OFF.

See us at the National Plastics Exposition, Booth 126, Cleveland, June 7-10

products change . . .

trim assembly's "bite" in

When you have planned assembly savings, make sure they *pay off* on the assembly line by specifying PARKER-KALON Self-tapping Screws. The *originator* of these time-proved metal fasteners, P-K learned long ago how to provide the proper combination of hardness and toughness, the sharp threads and accurate size, the consistent dependability that keeps assembly trouble-free.

Question *every* fastening, on the drawing board, and in present assemblies. Plan now to make savings you've been missing. A P-K Assembly Engineer will call at your request. Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.

The INDUSTRIAL DISTRIBUTOR steers your Supply Dollars to the best values

Assembly's percentage of total production costs runs from less than 10% in simple "gadgets" to as much as 75% in modern aircraft. Trimming this percentage to the lowest figure possible—eliminating all needless expense—is a challenge to every manufacturer whose assemblies involve fastenings to metal or plastics.

It's a job that will be just as important in 1964 as in 1954, regardless of changes in product design. Parker-Kalon's fastening specialists will be ready then, as they are now, to help you set new records for low cost assembly.

production costs with . . .

PARKER-KALON®

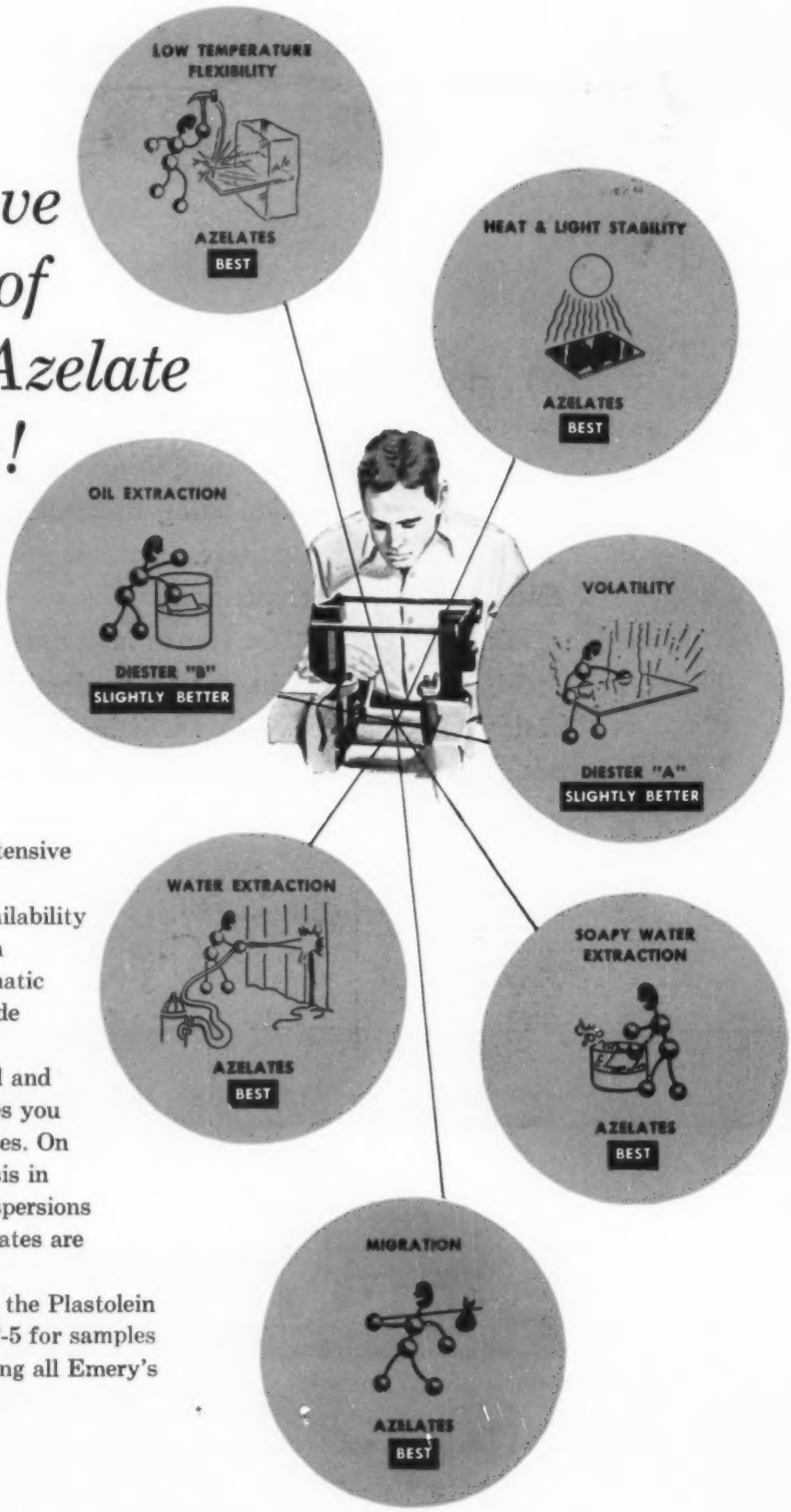
IF IT'S P=K IT'S O.K.

The Original **SELF-TAPPING SCREWS**

Cold-forged **SOCKET SCREWS**

AND OTHER FASTENING DEVICES

Tests Prove Superiority of Plastolein® Azelate Plasticizers!



DIRECT COMPARISON PROVES ADVANTAGE OF AZELATES OVER OTHER ALIPHATIC DIESTER PLASTICIZERS!

It will pay you to start an extensive evaluation of the Plastolein Azelate Plasticizers. With availability increasing, the choice between these Azelates and other aliphatic diester plasticizers can be made on performance alone.

Check the points illustrated and see for yourself the advantages you get from the Plastolein Azelates. On a performance versus cost basis in films, sheeting, extrusions, dispersions and coated fabrics, these Azelates are your best buy today.

Don't delay . . . investigate the Plastolein Azelates today. Write Dept. F-5 for samples and descriptive booklet covering all Emery's Plastolein Plasticizers.

Emery

Fatty Acids & Derivatives
Plastolein Plasticizers
Twitchell Oils, Emulsifiers

Emery Industries, Inc. Carew Tower, Cincinnati 2, Ohio

New York • Philadelphia • Lowell, Mass. • Chicago
San Francisco • Cleveland

Warehouse stocks also in St. Louis, Buffalo, Baltimore and Los Angeles

Export: 5035 RCA Bldg., New York 20, New York

Hold everything!

Before You Buy Any...

Plastic Molding Machine

be sure to see the New Improved
High Speed • Fully Automatic

MOSLO Model 73

FOR
PERFORMANCE
CAPACITY
DEPENDABILITY
SIMPLICITY
SAFETY
APPEARANCE

THIS GREAT NEW MOSLO MACHINE Has Everything

Pardon our extreme enthusiasm. We *do* get carried away, but only because we think you'll agree with us when you see and inspect the new Model 73. It's rated at 1200 cycles per hour. It will shoot a full two-ounce shot. Plasticizing capacity is 25 pounds *plus* per hour, and it will mold 20 square inches of area *plus.*

These figures tell only the rated capacity, but *how it performs* is the really exciting story.

This space doesn't permit us to give more than a hint of the many fine features it has—the completely new oil tank with manifold, the really effective control system, the many provisions for handy servicing, and dozens of other leading features. Yet, these things add up to dependable year-round production and greater profits. That's why we want you to be sure to see it.

Write, wire or call to arrange a demonstration. We have a Model 73 set up for a working demonstration at your convenience.

MOSLO MACHINERY COMPANY
2443 PROSPECT AVENUE • CLEVELAND 15, OHIO

There's more to these millions than meets the eye!

Over 3¾-million families,
screened for the BUY on their minds

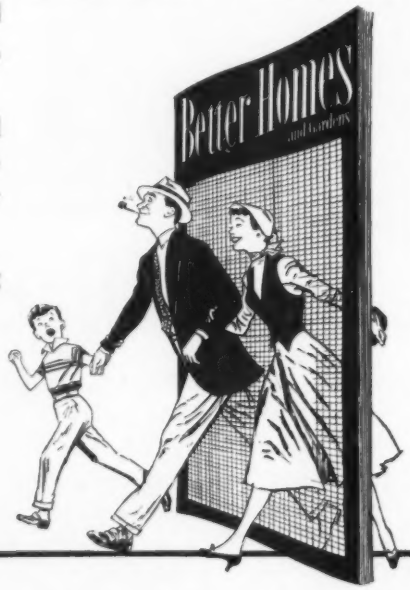
ALONE of America's largest man-woman magazines, Better Homes and Gardens *preconditions* its readers for the plastics products you have to sell.

It *starts* with editorial planning that screens them for high income, home ownership, and the active desire to lead richer, fuller lives.

It *continues* by helping them toward their goals—telling them what to do, how to do it, and what to buy to do it with.

It *completes* the job by establishing a buying urge in every issue, from cover to cover.

That's why your advertising is a continuation of editorial—not an interruption. So there's more to these over 3¾-million families than meets the eye!



BH&G is your primary medium for plastics—in which your advertising works harder—dollar for dollar, line for line, page for page.

Tell your plastics story in BH&G!

MEREDITH PUBLISHING COMPANY, Des Moines, Iowa

Serving over 3¾-million families,
screened for the BUY
on their minds!

BH&G BUYological Briefs

• A plastics manufacturer ran *one* ad offering a sample in BH&G. Result—12,172 dimes came in!

• What better test of pulling power than ads soliciting inquiries? What better proof of BH&G *power* than the fact that—in issue after issue—over *half* the ads in BH&G solicit inquiries!

• Without fiction to attract them, BH&G families read it to learn—and learn to buy. Alone of the three biggest man-woman magazines, BH&G serves its readers as a buying guide.

TROWELS
Goldblatt Tool Co.
Kansas City, Mo.

SCREW DRIVERS
Stanley Tools
New Britain, Conn.

GUN CLEANING RODS
Erwin Weller
Sioux City, Iowa

GUN CLEANING RODS
Frank A. Hoppe, Inc.
Philadelphia, Pa.

The Favorite Handle Materials of Leading Manufacturers are NIXON PLASTICS

NIXON C/A — cellulose acetate

NIXON C/A/B — cellulose acetate butyrate

NIXON E/C — ethyl cellulose

Literally millions of superior handles have been fashioned from damage-defying, consumer-pleasing Nixon Plastics. Easily and inexpensively machined from Nixon rod stock, these handles have virtually wiped out handle breakage and failure, even under conditions of most rigorous use. What's more, their pleasant feel in the hand and hefty appearance (even though they're light in weight) have proven to be features which purchasers prefer.

Full information on the many additional advantages of hard-working, good-looking handles fabricated of Nixon Plastics is available from S. A. Wetty & Sons, Royersford, Pa. Contact them today.

CHECK THESE OUTSTANDING PROPERTIES

• resilient toughness • high impact strength • dimensional stability
great mechanical strength • low moisture absorption
dielectric strength • rainbow colors

NIXON NITRATION WORKS

Founded 1898

NIXON • NEW JERSEY

Home Office: NIXON, NEW JERSEY • Phone Charter 9-1121 • New York Extension WOrth 4-5290

M. BREITKOPF, R. FORD, W. B. SAVAGE, K. P. WHITING, W. A. OLSEN, G. L. LOTZ, W. G. TUCKER, S. NIXON, M. W. PETERS, A. J. BALDWIN

Chicago, Ill.
F. W. LINDAHL
MRS. M. FAHRINGER
510 North Dearborn Avenue
Phone: Michigan 2-2363

St. Louis, Mo.
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A. F. PERRY CO.
A. F. PERRY
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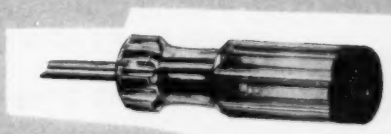
CANADIAN DISTRIBUTOR: CRYSTAL GLASS & PLASTICS, LTD., 130 QUEENS QUAY E., TORONTO, ONTARIO, CANADA

WOOD CHISELS
Stanley Tools
New Britain, Conn.

ICE CREAM DIPPERS
Bonny Products, Inc.
New York, N. Y.



SCREW DRIVERS
Bridgeport Hardware Co.
Bridgeport, Conn.

SPARKPLUG TESTER
Stanley Tools
New Britain, Conn.

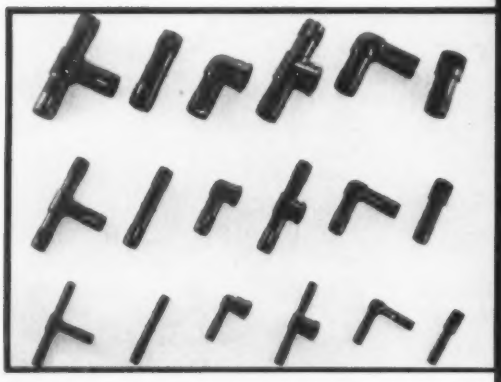
All of the handles illustrated are fabricated by S. A. Wetty & Sons

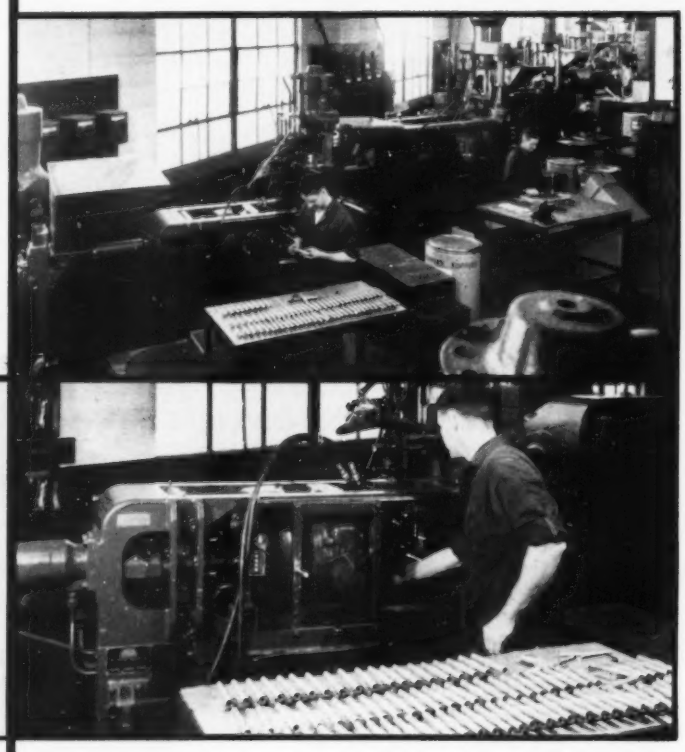
SCRAPERS
Goldblatt Tool Co.
Kansas City, Mo.

5 reasons why R&K Tool prefers molding

PIPE FITTINGS on LESTERS

R & K Tool & Die Co. (another all-Lester shop) is molding plastic fittings for polyethylene pipe applications for Industrial Plastic Fittings Co. R. A. Rybak, Chief Engineer for R & K says, "We depend on Lesters; not only for the machine features, but also because of the excellent cooperation we get from the company in solving specific problems."





GENEROUS PLATEN AREA . . . . . Because of the cam action, two small pipe "T's" require a 24-1/2" x 26" clearance when the slides are open. Such a mold can still be run in an 8 ounce Lester because of its big platen area.

CENTRAL DIE HEIGHT ADJUSTMENT . . . With 36 different fittings to stock, rapid mold changing is a regular requirement. Down-time for mold changes is reduced to an absolute minimum, with single hand crank die height adjustment.

METERED TOGGLE ACTION . . . . . Complex horn molds demand smooth toggle action—Lester's can give uniformly slow movement, metered for the full stroke, opening and closing.

CUSHIONED MOLD ACTION . . . . . Cushioned mold closing and cushioned ejection protects the precision threaded inserts from damage.

BETTER PLASTICIZING . . . . . Thorough plasticizing from the internally heated cylinder helps considerably in producing strong plastic pipe fittings.

See a new model LESTER running at the Plastics Show—June 7 to 10

LESTER INJECTION MOLDING MACHINES

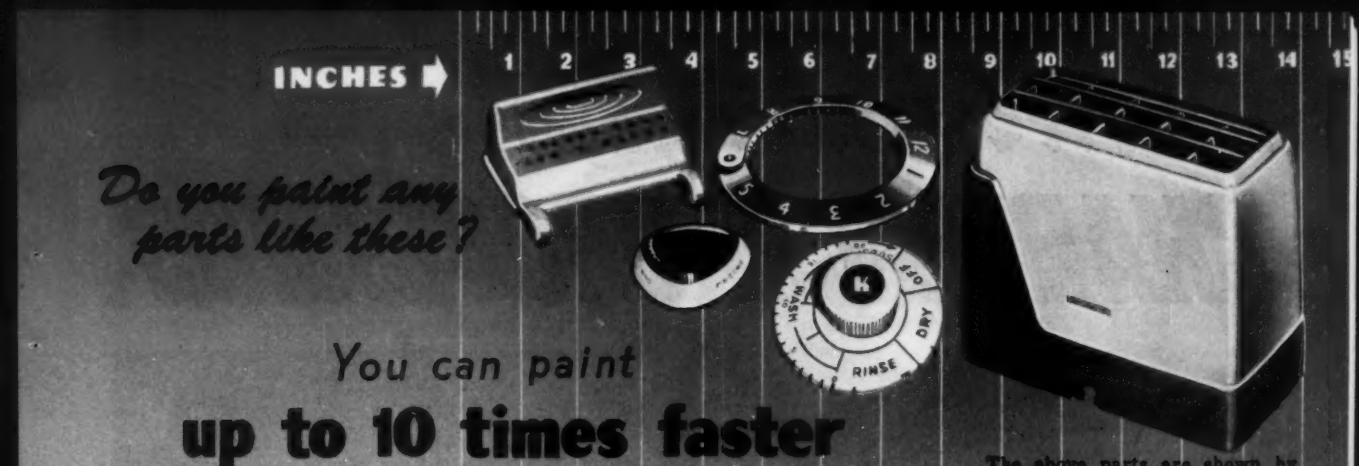
REPRESENTATIVES

New York . . . . Steven F. Krould
Detroit . . . . . Thoreson-McCosh
Chicago . . . . . J. J. Schmidt
Cleveland . . . . . Don Williams
Coral Gables . Morton Machinery Sales
Seattle . Perine Machinery & Supply Co., Inc.
Cincinnati . . . Index Machinery Corp.
Los Angeles . . . Seaboard Machinery Co.
San Francisco . . . . . J. Fraser Rae
St. Louis, Milwaukee . . . . . A. B. Geers
Providence . . . . Sydney W. Lohman

FOREIGN

Toronto, Canada . . Modern Tool Works, Ltd.
Sydney, Australia . . . Scott & Holladay, Ltd.
Japan . . . . Okura & Co., New York, Inc.

distributed by LESTER-PHOENIX, INC., 2621-V CHURCH AVENUE • CLEVELAND 13, OHIO



Do you paint any parts like these?

The above parts are shown by courtesy of Amos Molded Plastics, Argus Cameras Inc., The Haas Corporation, and Nameplate & Monogram Co.

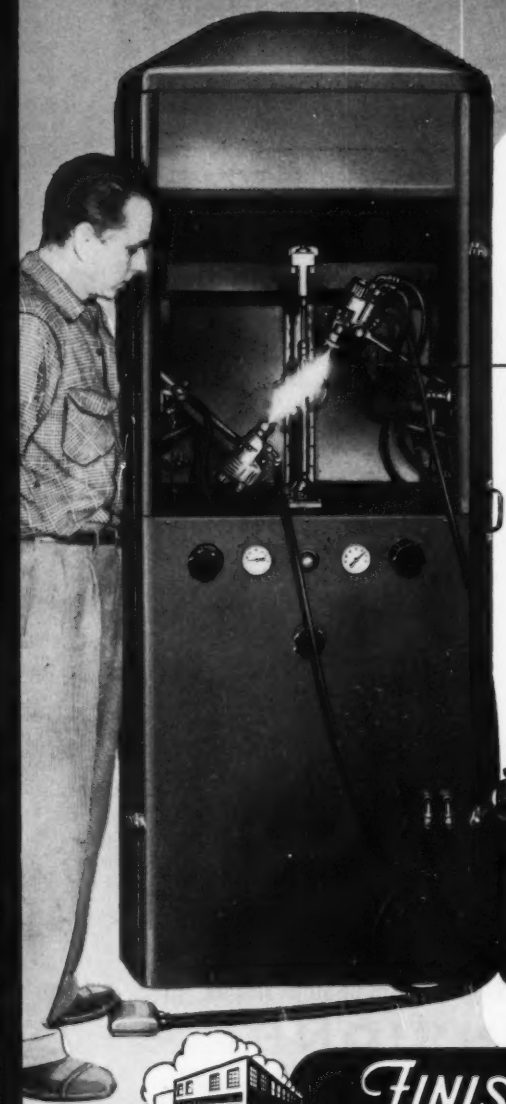
You can paint

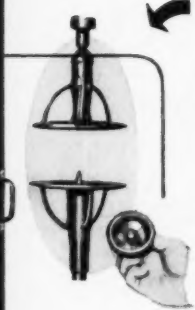
up to 10 times faster

with the

RotoSprayer

Up to 1,200 pieces per hour





Hold-down pushes part into mask, or can be used for mask on top side.

OSCILLATING GUN reaches the hard places on parts with angles, corners and bridges. Makes set-up easy. Stationary gun positions also provided.

Always stops at same place for easy feeding of parts. When the spindle stops rotating, the mask opening is always in the same position.

Experienced operators NOT required.

HOW IT WORKS: The operator loads the part, touches the foot valve— and the machine takes over: **Automatically** the hold-down grips the part, rotation starts, paint guns go on, then off, rotation stops, the hold-down releases.

A complete painting machine including Booth, Fan, Guns, Pressure Tank. **100% air operated . . .** no fire hazard. Filtered air carries lubricant to moving parts.

How much can <u>you</u> save by painting with the Finish RotoSprayer? We'll be glad to estimate . . . send us sample part.

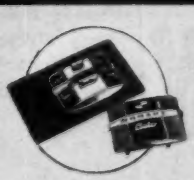
FINISH ENGINEERING CO., INC., 1115 Cherry St., Erie, Pa. Phones 4-6182 or 5-1690.

FINISH ENGINEERING CO., INC.

Makers of many tools for your decorating needs, including . . . Spray Painting Machines, Automatic and Semi-Automatic. Automatic Dial Wipers. Spray Painting Masks of all types. Adjustable Air Clamping Fixtures. Vacuum Plating Racks. New Brushless Mask Washers.

Painting Machines

Automatic Dial Wipers



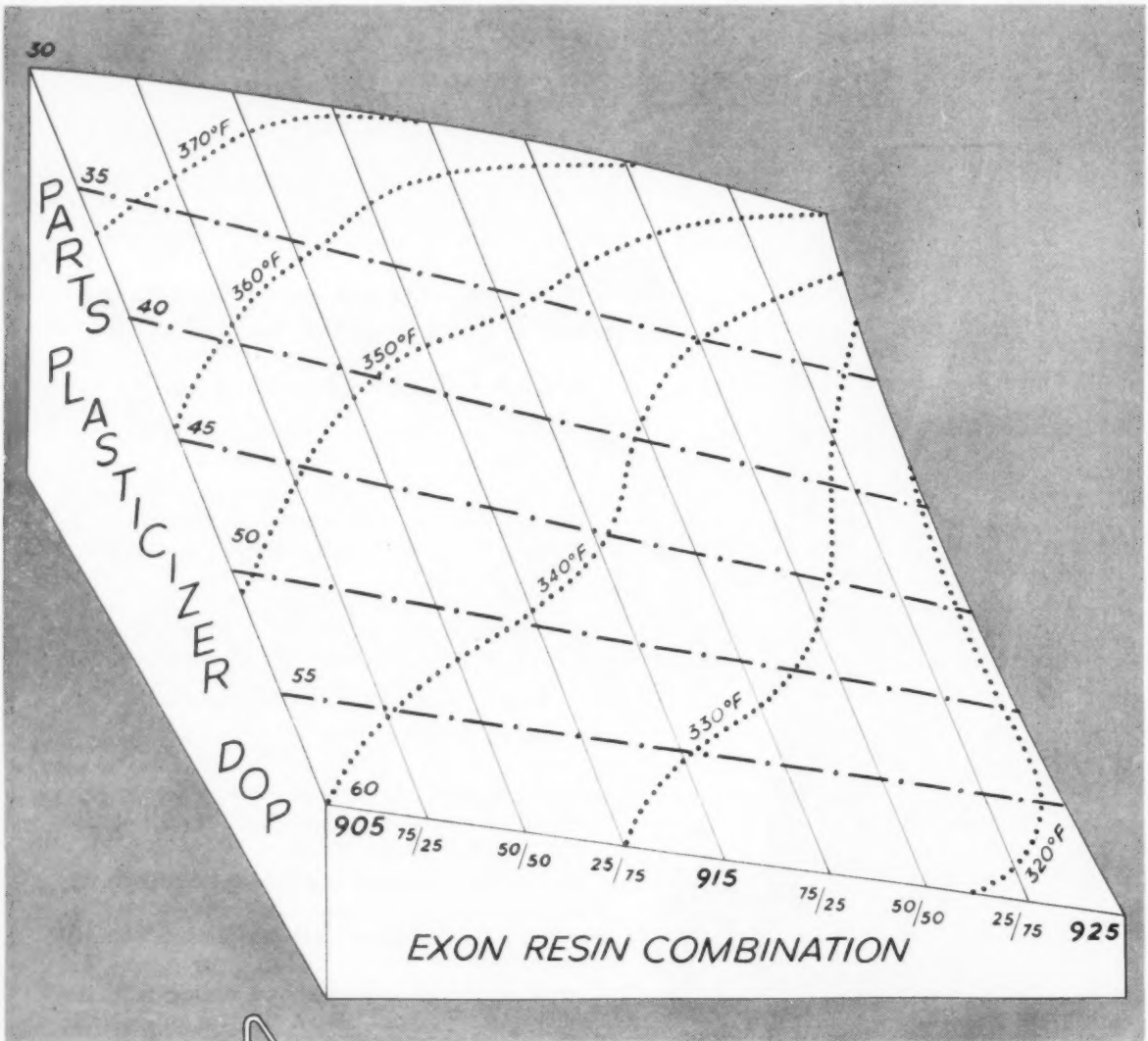
Spray Masks

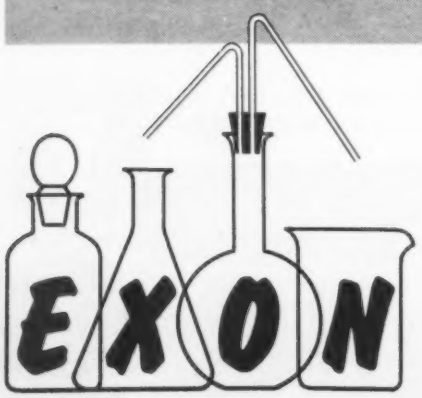
Adjustable Fixtures

Mask Washers

now Firestone *helps you*

CHART YOUR PROCESSING





Firestone Service charts your processing needs in

3 DIMENSIONS!

Consult this unique chart to determine the proper combination of Exon resins best suited to your processing conditions.

Follow the broken guide lines indicating Parts Plasticizer to the intersection of your Operating Temperature, indicated by dotted lines. Carry this point parallel to the solid black lines down to the Exon Resin Combination at the bottom of the graph.

PROBLEM...AND SOLVE IT!

with Firestone's 3 new versatile, temperature-tailored resins

EXON 905 – 915 – 925

Operating temperature is virtually eliminated as a production problem by Firestone's 3 new EXON resins—905–915–925.

You need only determine your plasticizer loading and your operating temperature. Spot them on the chart at left—and you find the temperature-tailored resin or blend ideally suited to perform in your processing with excellent results.

These fast-fusing Exon resins offer you several inherent advantages. Among them are:

- Extremely rapid blending . . . hot or cold.
- Freedom from fisheyes . . . for higher quality, greater product uniformity.
- Shorter fusing time . . . assuring a faster, more economical operation.

For final adjustments to given processing conditions, a blend of one or more of the Exon resins may be used.

CHEMICAL PROGRESS WEEK-MAY 17-22

A BETTER AMERICA THROUGH CHEMICAL PROGRESS

Be sure to visit the Exon booth at the forthcoming shows:

SPE THE SIXTH national plastics exposition CLEVELAND JUNE 7-10 1954

Space 341

BASIC MATERIALS EXPOSITION

Space 128

PHYSICAL PROPERTIES

	FORM	SPECIFIC GRAVITY	AVERAGE RELATIVE VISCOSITY	AVERAGE BULKING DENSITY
EXON 905 Excellent for film and sheeting applications where higher temperatures (up to 375° F.) are called for.	White Powder	1.40	2.50	0.45
EXON 915 High-versatility, resin specially designed for sheeting. Wide range of operating temperatures.	White Powder	1.40	2.30	0.45
EXON 925 An excellent P. V. C. resin for low processing temperatures. (starting at 275° F.)	White Powder	1.40	2.05	0.45

For further information on Firestone's complete line of high quality EXON resins . . . or for the assistance of Firestone's Technical Service, call or write:

CHEMICAL SALES DIVISION

FIRESTONE PLASTICS COMPANY • POTTSTOWN, PA., DEPT. 2A

Division of The Firestone Tire & Rubber Co.

One OPERATIVE TENDS *Six*

CUTS MOLDING TIMES & COSTS

CUTS MOLD COSTS

SIMPLE TOOLING
ENABLES RAPID MARKETING

FASTER THAN ANY
COMPARABLE MACHINE

DOWDING

Fully Automatic
Fast-Cycling

INJECTION MOLDING MACHINES

Up to 1,200 cycles per hour
Fully automatic and foolproof
Fast plasticizing at unusually low injection pressure
Automatic lubrication
3-zone cylinder heating
Vickers-Detroit hydraulic equipment

***BRITISH MADE**
***EARLY DELIVERY**

Sole Distributors for U.S.A.

Ralph B. Symons Assoc. Inc.
3571 Main Road, Tiverton, R. I.

SPECIFICATION

Approximate weight of material plasticized per hour (Dependent upon weight per shot and material used)	22 lb.
Area of injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on injection plunger	18,850 lb.
Mold opens (adjustable)	6—9 in.
Maximum die space	7½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mold	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD
346 KENSINGTON HIGH STREET LONDON ENGLAND
Cables: ACCURATOOL HAMMER LONDON

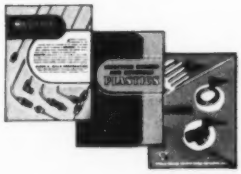
A30

Flashlight Housing molded for BURGESS BATTERY CO. Freeport, Illinois

Skillful Molding

solves a flashlight's housing problem

Economical production has a special meaning for us that always results in better plastic products for you. Low priced—high volume items like this Burgess pocket flashlight illustrate how we put economy and quality to work together. Naturally costs had to be kept down while keeping quality "up" in producing this flashlight housing. Although it is a small and outwardly simple case, actually there was a definite and unique problem solved by making full use of a surprisingly compact space. Through careful engineering and advance planning we have developed our own method of cutting costs without ever cutting quality. This production skill that saves you money while giving you a better job is the core of our service to you. Let us show you how we can combine economical production and quality craftsmanship for your product. Tell us today when you want to see us.



Write on your letterhead for new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted], piping, tubing and fittings, write for circulars containing data and illustrations.*
**Trademark Registered*

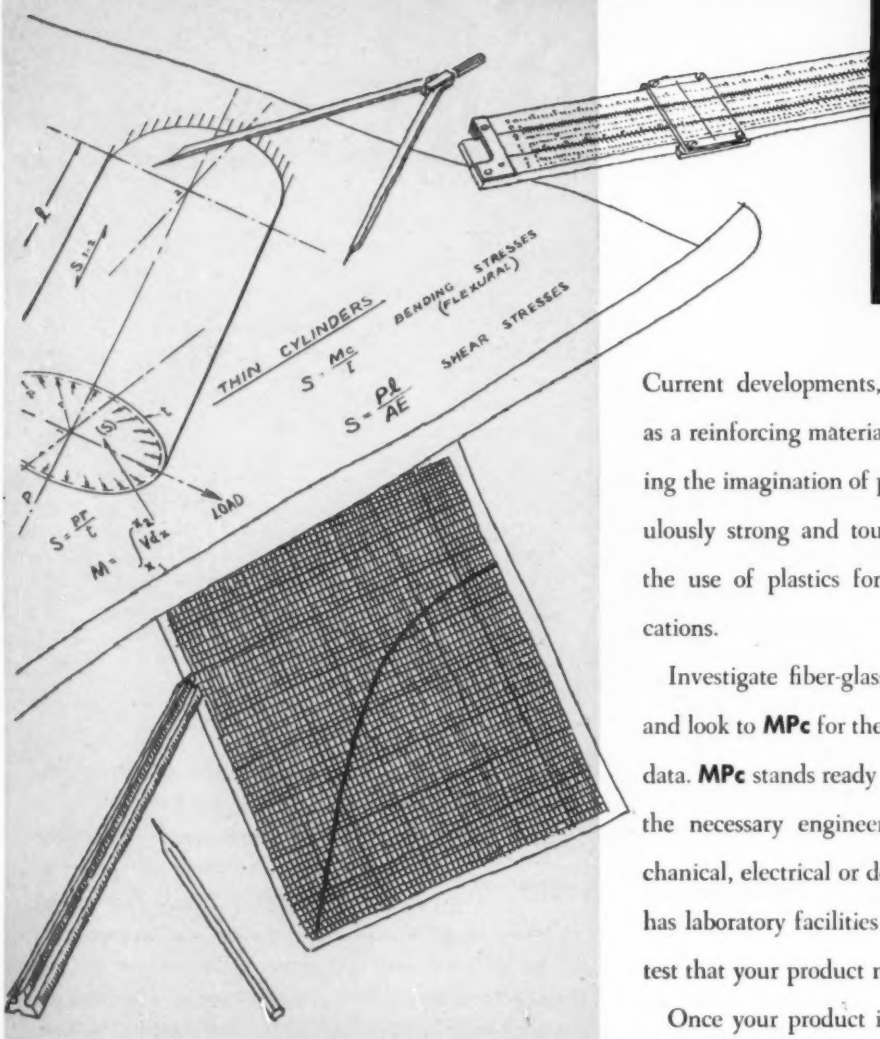
CONTINENTAL CAN COMPANY

MILLS PLASTIC DIVISION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Fibestos, Lucite, Nylon, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Cerex, Forticel, [redacted]*, Saran, and other Thermoplastic Materials.

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Look to MPc for Engineering Assistance on Fiber-Glass Reinforced Plastics



Current developments, employing fiber-glass as a reinforcing material for plastics, are exciting the imagination of product designers. Fabulously strong and tough, fiber-glass permits the use of plastics for countless new applications.

Investigate fiber-glass reinforced plastics... and look to **MPc** for the necessary engineering data. **MPc** stands ready to assist you in making the necessary engineering evaluations...mechanical, electrical or design application. **MPc** has laboratory facilities to make every type of test that your product may require.

Once your product is past the engineering stage, **MPc** offers unexcelled tooling and production facilities. Address your inquiry to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Ill.

MOLDED MPc PRODUCTS

DIVISION OF
ADMIRAL DISTRIBUTORS, INC.
4535 W. Harrison St., Chicago 24, Ill.

...Pace-Makers in Plastics Molding

MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

Penny-Pincher...

CYCOLAC

A *New* HIGH-IMPACT THERMOPLASTIC RESIN

gives you greater all-around ECONOMY in production!

Here at last is a single uniform resin which is permanently thermoplastic, permitting fast molding, calendering and extruding, and re-use of trim and cutting scrap.
Cycolac is also economical to form from press-polished sheets by vacuum, air-pressure, or mechanical methods over inexpensive molds of wood, plaster, aluminum, etc.

Cycolac is free from nerve or shrinkage, permitting accurate calendering and extruding. High in impact-resistance and heat-distortion temperatures, low in brittle point. Also very light with Sp. Gr. of 1.01. Capable of being colored to about any opaque shade. Capable of being solvent or heat-welded; can be machined much like other rigid thermoplastics.

GET THE FACTS — *Write* TODAY FOR TECHNICAL LITERATURE

Marbon

MARBON CORP.

GARY, INDIANA

SUBSIDIARY OF BORG-WARNER

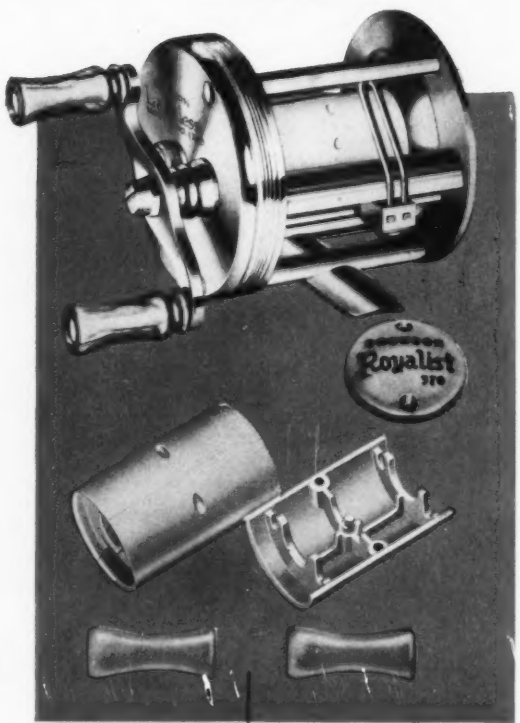
MARBON . . . *Precision Resins for Precision Made Products*

"A Sure Catch for REEL ANGLERS"

custom molded and finished in

TRADE ERIE MARK

Three Dimensional Plastics



This intriguing three dimensional plaque is sure to catch the angler's eye on the counter or in the window of any sporting goods dealer who displays it . . . and its rare beauty is assurance that it will have a prominent place. The plaque is 4" by 8", with a ruby-red background that catches every ray of light. The reel and lettering are in shining silver, and all is permanently protected for a long sales life.

ERIE Three Dimensional Plastics are the richest thing you can buy, for signs, name plates, or trademarks. We can show you an amazing assortment of samples, produced for America's leading manufacturers in many lines.

ERIE CUSTOM MOLDED PLASTIC PRODUCTS for . . .

- Automotive Industry
- Radio and TV Industry
- Electrical Appliance Industry
- Amusement Industry
- Photographic Industry
- Dentist's and Doctor's Equipment
- Three Dimensional Name Plates
- National Defense

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

TRADE ERIE MARK

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

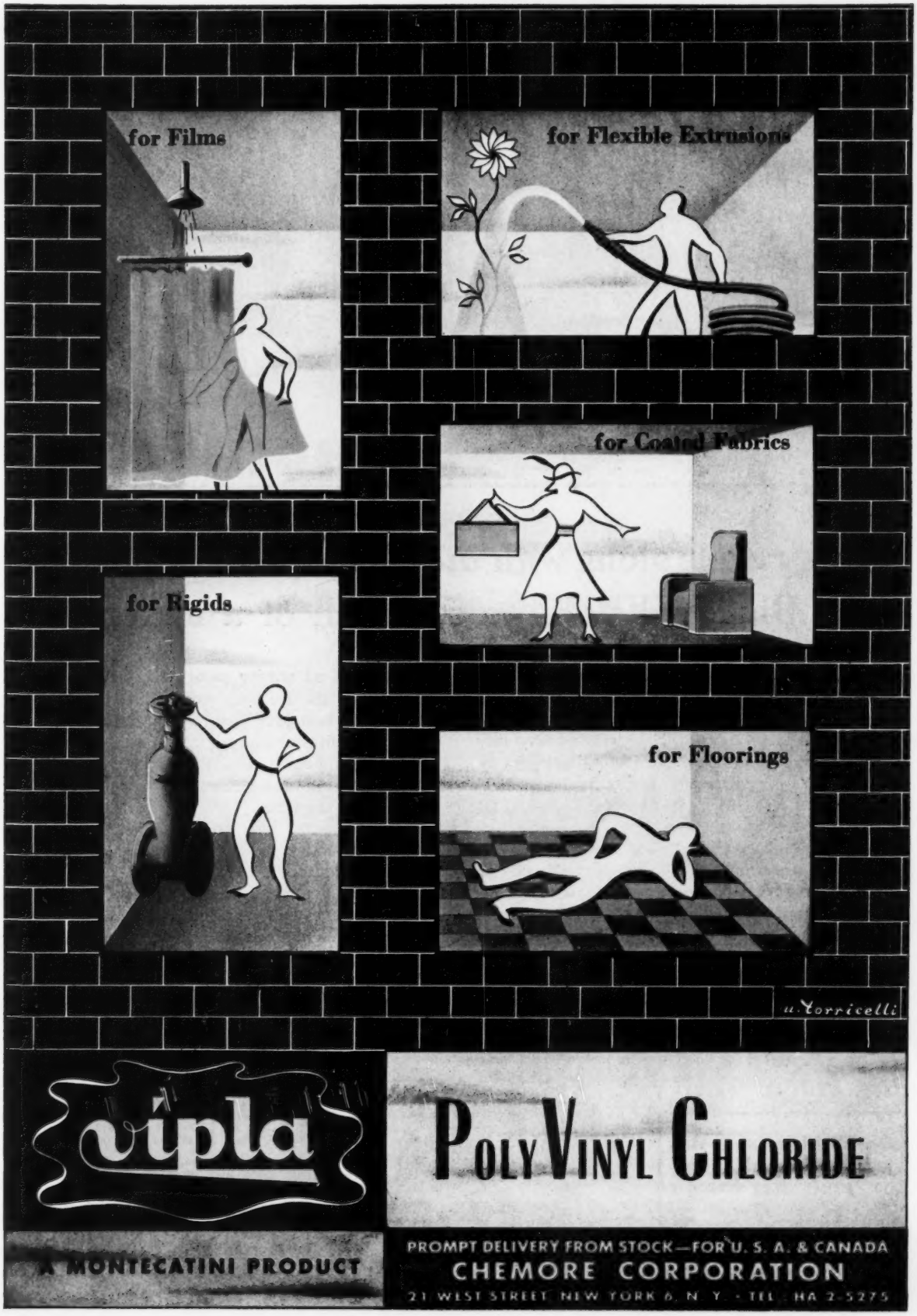
Main Offices and Factories: **ERIE, PA.**

Sales Offices: Cliffside, N. J. • Philadelphia, Pa. • Chicago, Ill. • Detroit, Mich. Ashland, Ohio • Fort Wayne, Ind. • Los Angeles, Calif. • Toronto, Ontario

Manufacturing Subsidiaries:

HOLLY SPRINGS, MISS. • LONDON, ENGLAND • TRENTON, ONTARIO

ERIE also molds the snap-on two-piece precision fitting arbors, handle grips and name buttons for several models of Bronson Reels.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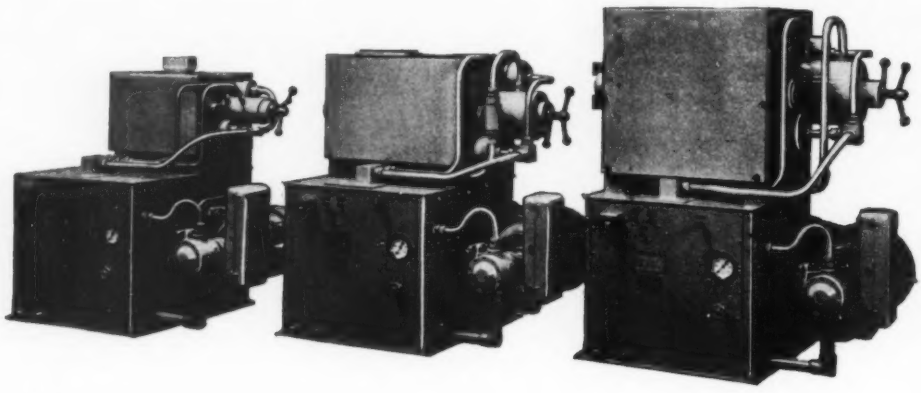

Clean-up is minimum because there is no powder spillage —filling takes place *within* the hopper

Patents applied for

Why struggle along with *old fashioned* preformers when Bipel pelleters do so much of a better job?

Compression molders who have long sought the advantages of *hydraulic* preforming combined with the rapidity of mechanical preforming and with minimum need for maintenance will find what they have been looking for in Bipel Horizontal Hydraulic Pelleters. These machines simplify the job of making sound preforms at high speeds.

Bipel Pelleters use the main ram for compressing the powder only; filling and ejecting depend on rapid movements of the die and hopper. Thus, the powder is compressed not by a blow as in mechanical preforming, but by a *steady squeeze* that can be applied long as needed to compact the powder. The dwell and the pressure can be accurately set for any particular powder in a matter of a few seconds. Even difficult powders can usually be preformed successfully.

Moreover, no moving parts come between the punches, so the machine cannot suffer damage. The die is completely free during the squeeze, which is equivalent to applying pressure on both punches. As a result pellet density is always uniform, even when square, rectangular or ring-shaped punches are used.

Bipel Hydraulic Pelleters are completely self-contained with their own motors and pumps (shop air supply is used for the controls). Since pressure builds up only during squeeze and ejection, the motors idle most of the time. Power consumption is small.

Send for descriptive folder

maximum pressure	12 tons	35 tons	70 tons
maximum strokes per hour	2280	1260	720
typical pellet weight*	.2—1.2 oz. (1½" dia.)	3.7—8.1 oz. (3" dia.)	8.3—18 oz. (4½" dia.)

*based on average powder density of .35 ozs. per cubic inch

Complete information on these pelleters and on Bipel "auto control" presses can be obtained in the United States from:

Ralph B. Symons Associates, Inc.
3571 Main Road
Tiverton, Rhode Island

B·I·P GROUP

B. I. P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

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AND *a vacuum forming service for experimental and engineering purposes*

- To take over the development and improvement of your products
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THE GILMAN BROTHERS COMPANY

EST. 1897 GILMAN, CONN.

Robbins

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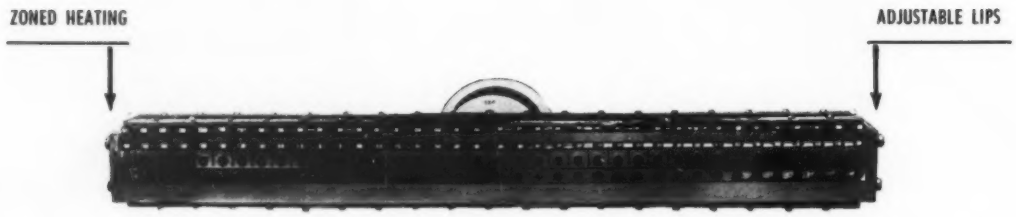
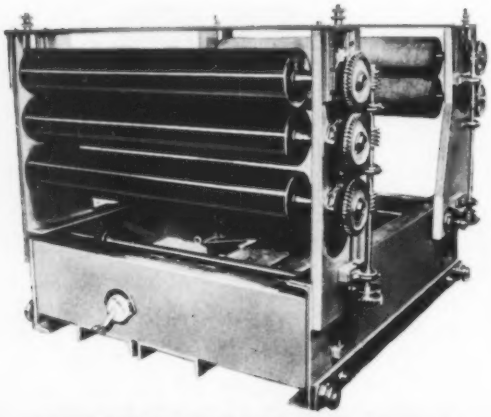


Readily Adapted To Your Extruder

Available in Widths Up to 60″

SHEETING DIES

for High Impact Styrene • Cellulose Acetate • Butyrate



SHEETING HAUL-OFF UNITS

Complete with Superfinished rolls and incorporating a variable speed transmission driving through a heavy-duty worm gear arrangement (shown with guards removed) to provide smooth tension on the extruded sheet.

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Available up to 84″ wide . . . with plain or perforated belt. This unit is supplied complete with variable speed drive.

ROBBINS TOOL & DIE COMPANY

1430 Mishawaka Street
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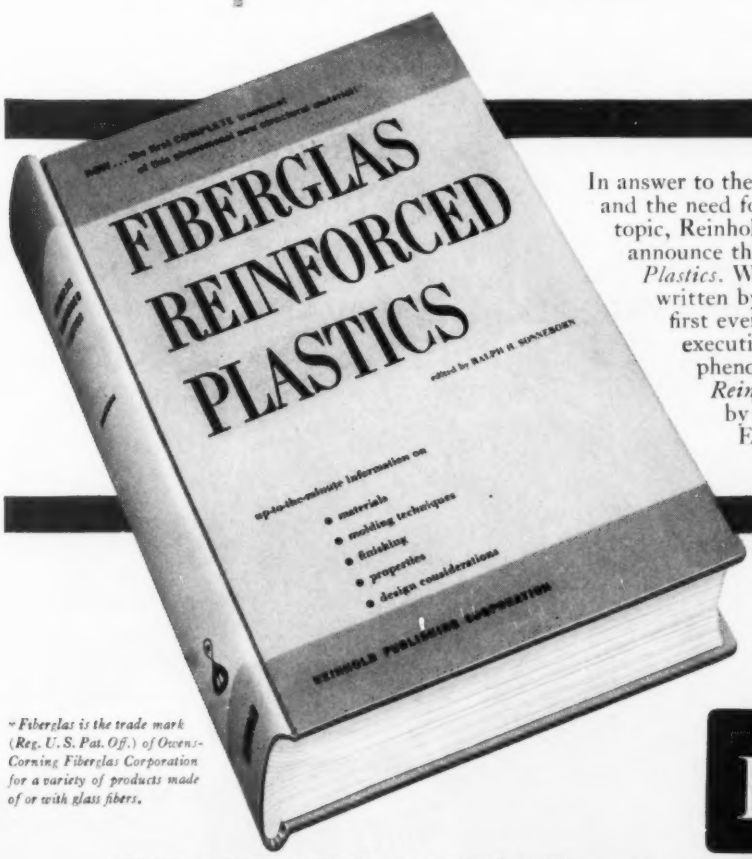
Plastics Extrusion Dies a Specialty

Fiberglas* salutes the first significant book on reinforced plastics



In answer to the deep interest in reinforced plastics, and the need for a readable treatise on this important topic, Reinhold Publishing Corporation soon will announce the publication of *Fiberglas Reinforced Plastics*. We salute this comprehensive manual, written by plastics engineers. It is the first ever to give designers and industrial executives a detailed picture of this phenomenal structural material. *Fiberglas Reinforced Plastics* will be introduced by Reinhold at the National Plastics Exposition in Cleveland.

250 PAGES . . . CHAPTERS on

Materials and their Properties • Theory and Basic Concepts • Design Considerations
Molding Techniques • Applications
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**Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.*

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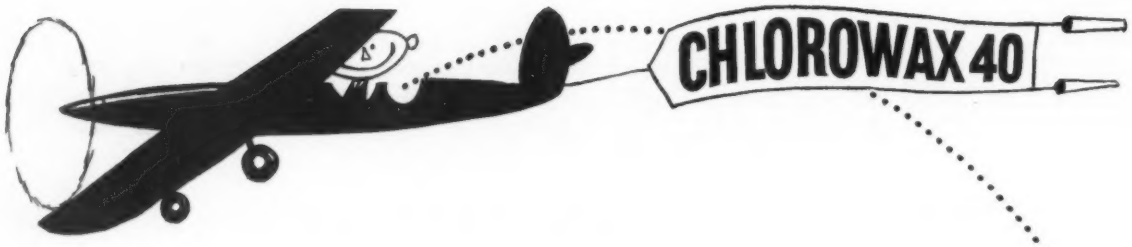

How to Lower Vinyl Compounding Costs

Chlorowax* 40 and Surfex* MM can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. Chlorowax 40 is DIAMOND ALKALI's liquid chlorinated paraffin which has gained wide acceptance as a low-cost co-plasticizer. Surfex MM is one of DIAMOND's precipitated calcium carbonates—a filler of high uniformity and purity.

The table below shows how these DIAMOND Chemical products can be used to produce two-way savings. Your nearby DIAMOND Sales Office can show you other moneysaving formulas and supply detailed cost comparisons, or write DIAMOND ALKALI Co., 300 Union Commerce Building, Cleveland 14, Ohio. **s

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TRY THIS RECIPE FOR LOWER COST VINYL COMPOUNDS

	Parts
PVC Resin	100
Primary Plasticizer	50
Chlorowax 40	10
Stabilizer	3
Stabilizer-Lubricant	0.5
Surfex MM	20
	183.5
Hardness	85A
Tensile Strength	2600 psi
Elongation	375%
100% Modulus	1400 psi
Crescent Tear	375 lbs./in.
Brittleness-Temperature	-29°C
Heat Loss	4.7%

DIAMOND ALKALI CHEMICALS®

DIAMOND ALKALI COMPANY
CLEVELAND 14, OHIO

Let's sit down——— ——and talk things over

Here at Adamson we've been doing something that we believe is rather unique in the industry. Every now and then a manufacturer of rubber or plastics has expressed a desire to discuss certain problems pertaining to calendering or calendering equipment, and we have invited him and his associates to our conference room for a roundtable session with our staff. No one dreamed the idea up—it just grew. Some of the largest manufacturers in the industry have been our guests and have described the meetings as helpful and enlightening.

Certainly, since we build calenders and related equipment, these clinics have been of great value to us. And because we believe that a free exchange of opinions and ideas is the surest way to promote progress and improvement in any industry, we extend to you and your company a cordial invitation to our conference room. Perhaps, like the famous riddle of which came first, the chicken or the egg, many questions will have to be left unanswered, yet the benefits to be derived from a free discussion of our common problems cannot fail to be mutually helpful.

Why not 'phone or write us for a conference date? The obligation will be all ours.

ADAMSON UNITED COMPANY

BETTER MACHINES AND PROCESSES FOR BETTER RUBBER AND PLASTICS PRODUCTS

5-ton mold of CRUCIBLE CSM 2 produces butyrate hobby horse

Five tons of Crucible CSM 2 mold steel went into this two-cavity mold built by the Enduro Tool and Engraving Company, for Wonder Products, manufacturers of a new plastic hobby horse. Body of the horse, injection molded by Ger-Ell Manufacturing Company, is made of 5½ pounds of medium-flow ivory butyrate, in a mold measuring 40 x 18 x 55 inches, and weighing over 10,000 pounds.

It's with good reason that Crucible mold steels are specified for the big jobs. Made by the electric furnace process in the country's largest tool steel mill, Crucible mold steels actually *are* tool steels. And because they are tool steels you can be sure of uniformly high quality from piece to piece.

So, no matter how large or small your next job may be — call Crucible for your mold steel needs.

CRUCIBLE first name in special purpose steels

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HEAT V LIGHT

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for the vinyl plastic and coating industries

Important additives for processing and stabilizing clear and opaque vinyls—

CALENDERED FILMS AND SHEETS • EXTRUSIONS
PLASTISOLS • ORGANOSOLS • COATINGS

CADMIUM
2 — V — 4

Leading heat and light stabilizer for clear or opaque stock, an organic liquid complex containing no disadvantageous soapy component. Unequalled for stabilizing against effects of sunlight or outdoor aging.

BARIUM-CADMIUM
128 — V — 5

Leading combination of coprecipitated laurates for outstanding performance, where lubricating advantages are required. Generally 30% more effective than common barium-cadmium laurates.

Best effects are attained for particular requirements by combining 2-V-4 or 128-V-5 in a stabilizing system with one or more of the following three stabilizers.

BARIUM
1-V-4

Compatible barium compound, minimum effect on viscosity. Permits processing at higher temperatures.

ORGANIC
7-V-2

Epoxy assistant, highly effective HCl-scrubbing agent, undiluted. Will extend stability for longer processing periods.

ORGANIC
8-V-1

Chelating agent, more than two times as effective as common organic phosphites. Inactivates harmful by-products to boost stability. Contributes to top clarity.

Stabilizing Systems developed for Harshaw Customers, for special processing and finished product properties, may contain one of the following eleven stabilizers.

ZINC 9-V-1: Organic liquid complex containing no disadvantageous soapy component, used in selected formulations.
CADMIUM 24-V-1: Organic liquid complex for highest attainable clarity, used principally with dispersion resins.
CADMIUM 2-V-8: Selected laurate, used principally with low fusing resins.
BA-CD 12-V-5: Coprecipitated laurate.
ORGANIC 7-V-1: Epoxy assistant, modification of 7-V-2.
ORGANIC 8-V-3: Useful with particularly sensitive organic colors.
BARIUM 1-V-1: Modified ricinoleate, used in a few organosol formulations.
BARIUM 1-V-3: Dispersible stearate, to contribute lubricity with barium effects.
CADMIUM 2-V-5: Dispersible stearate, to contribute lubricity with cadmium effects.
CALCIUM 5-V-1: Dispersible stearate, to contribute lubricity with calcium effects.
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The Encyclopedia is your *basic* advertising medium in the plastics market, because it's the market's standard work book and buying guide.

To place your order—or to get more details—write to Breskin Publications Inc., 575 Madison Avenue, New York 22, N. Y.

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IT'S WORTH REPEATING . . .

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FELLOWS still sets the pace! Super speed cycling, hot news then, focused all eyes on the 3 oz. Fellows Machine.

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Now, still faster cycling through progressive addition of 15 separate machine-design improvements. FELLOWS still leads!

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injection molding equipment

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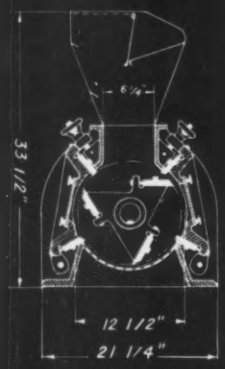

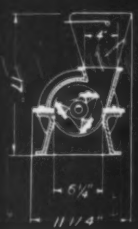

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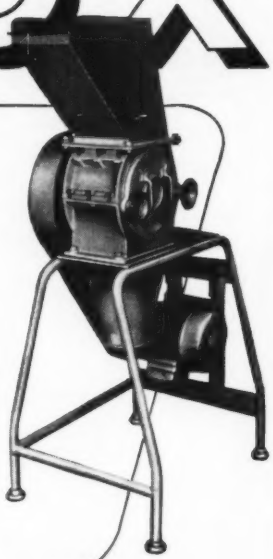

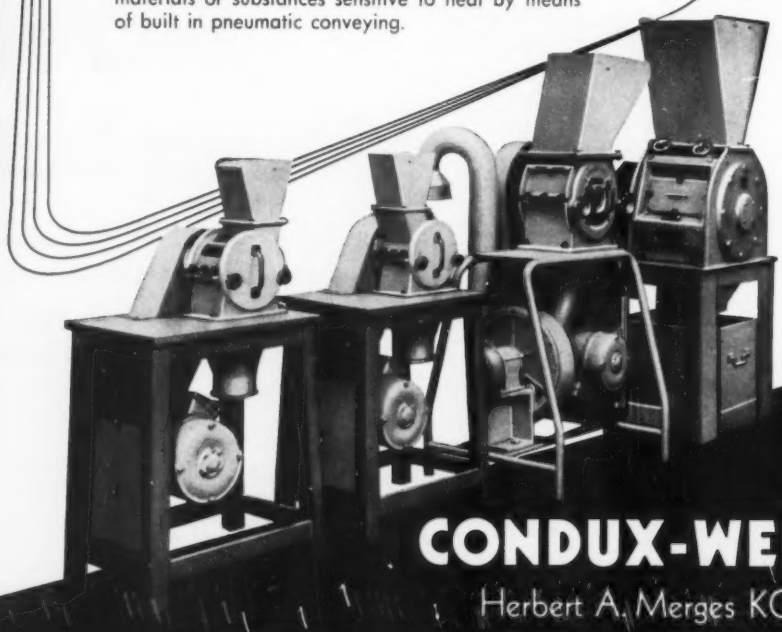

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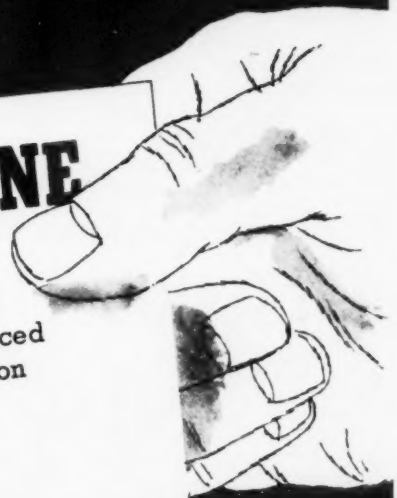

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If you sell plastic scrap . . . use reprocessed plastics or have your scrap reprocessed—look to Muehlstein for reliable service. Our complete laboratory facilities and technical staff assure satisfaction, especially with color problems.

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Production ste[illegible] 25% with NE[illegible] DURITE GP-102

25% faster curing! That's how DURITE GP-102 helps you lower costs. DURITE Phenolic Molding Powder is uniform in quality . . . carefully controlled from raw materials to the finished compound . . . assuring you of consistently high quality in every piece you mold.

Use DURITE GP-102 Black or Brown when you want parts with rich lustre and good strength. Available in a hard and medium flow, it is designed for a wide range of applications for either compression or plunger molding. It is easy to handle and preform and has a specific gravity of 1.36.

If you mold with phenolic compounds you ought to know the facts about DURITE GP-102. Just mail the coupon below for a sample and descriptive literature or to arrange a demonstration by your DURITE Technical Representative.

The Borden Company, Chemical Division MP-54
DURITE Products Department
5000 Summerdale Avenue, Philadelphia 24, Pa.

☐ Please send sample and technical description of DURITE GP-102
☐ Please have your technical representative arrange a demonstration of GP-102 in my plant

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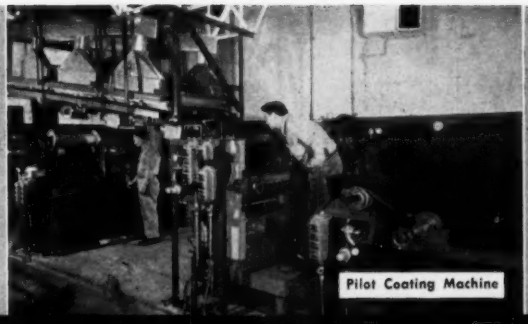
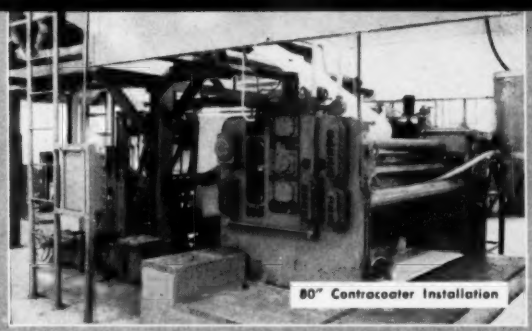
THE *Borden* COMPANY
CHEMICAL DIVISION

Phenolic Molding Compounds • Abrasive and Frictional Bonding Resins • Molding and Specialty Resins • Lamp Basing Cements



Pilot Coating Machine

CONTRACOATER* a reverse roll coater



80" Contracoater Installation

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for the coating of lacquers • resins • organisols • plastisols on paper • foil • fabric and film.

Arrange for your materials to be trial-coated on the Contracoater in the new Dilts Laboratory at Fulton. Bulletin DLF-1005 describes the new laboratory and outlines the arrangements for its use. Write for our new Coating Bulletin 12-DM.

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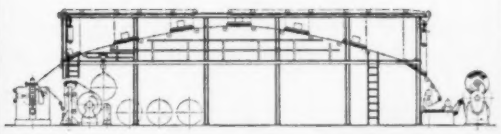

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DILTS MACHINE WORKS DIVISION
FULTON, NEW YORK

SOFT PLASTICS

Vinyl Plastisols

The versatility of vinyl dispersion (Plastisol) compounds lends itself to many wide and varied applications. The Watson-Standard laboratories can help you adapt these products to production and end uses.

Molding:

Watson-Standard Vinyl Plastisols and Rigidsols have been used with both slush molding and dip molding. Such items as doll and doll parts, toys, spark plug covers, electrical components, novelties, puppets, toilet valves, boats, light sockets and others are illustrations of this type of application.

Dipping:

Watson-Standard Vinyl Organosols and Plastisols have been applied by dipping. Varied end products include dishwasher baskets, dish racks and drainers, electrical wiring, gloves, and springs for the automotive and upholstery industries.

Spreading:

Watson-Standard Vinyl Plastisols and Organosols may be spread coated. Coated textiles and paper are typical of this type of application.

Spraying:

Special foundations of Watson-Standard Vinyl Organosols and Plastisols may be applied by spraying. Finishes for metal furniture, cabinets and blowers are representative uses.

Casting:

Since Watson-Standard Vinyl Plastisols are in liquid form and may be readily poured, they lend themselves to casting. Casting applications include films, sealants for automotive and refrigeration industries, ceramic pipe joint threads, and potting compounds.

Troweling:

Watson-Standard Vinyl Plastisols may be formulated for troweling. This type of application lends itself to linings for tanks and sealants.

The Watson-Standard laboratories have formulated compounds for many end uses and methods of application. We will assist you with your problems.

Watson-Standard CO.

225 GALVESTON AVE., PITTSBURGH 30, PA.

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PLASTICS · INDUSTRIAL FINISHES · CHEMICALS

Companies

you can trust

... trust Norton

● Like most chemical manufacturers who operate batteries of filter presses, National Aniline Division, Allied Chemical & Dye Corporation, were dissatisfied with the constant breakage and replacement of the wooden Filter Press Spigots and Keys they were using.

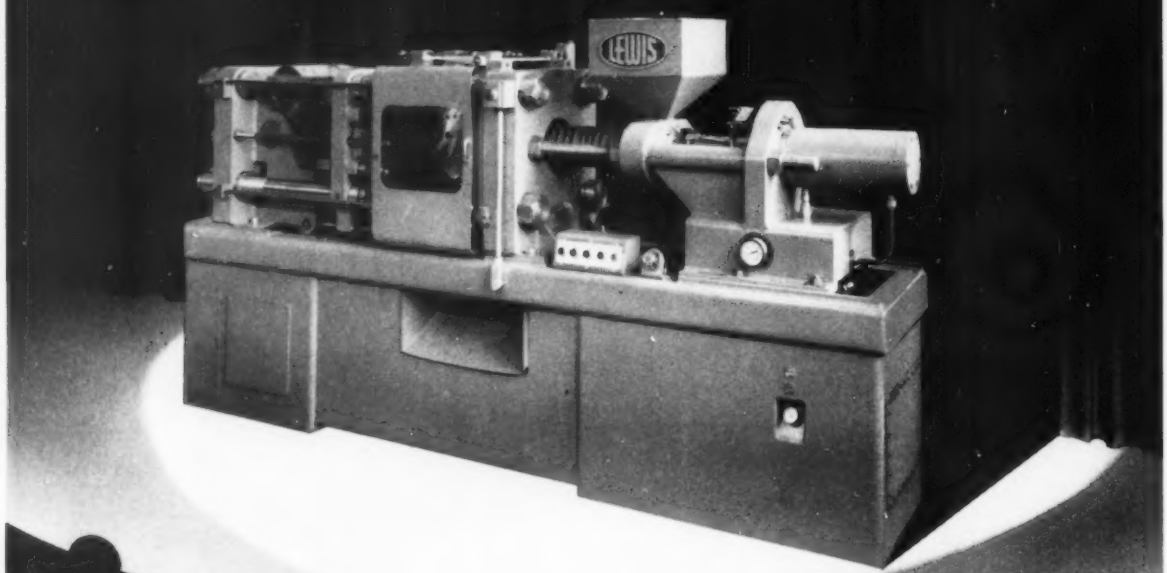
So National Aniline asked Norton to help. And we are now molding tough, long-lived Filter Press Spigot and Key Sets for them from resilient, highly shock and chemical resistant Durez Nitrile Rubber Bearing Phenolic. True, these new spigots cost a little more, but what a difference in the way they last!

For over twenty-five years Norton has been making fine compression and injection moldings *for companies you can trust*. Our service is notable for sensible pricing, sound engineering, and on-time deliveries. May we be of assistance to you? Norton Laboratories, Inc., Lockport, New York.
Sales Offices: New York—175 Fifth Avenue; Chicago—5221 Kimbark Avenue; and our newest sales representative, L. S. House, General Motors Building, Detroit, Mich.

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

Demand Performance



Featuring the Lewis "6" Injection Molding Machine

The LEWIS Model "6" has been designed to meet injection molders' specific demands for greater economy . . . versatility . . . speed . . . and safety. This new machine can do the work of much larger units at a fraction of their initial and normal operating costs. Engineered to produce a wide variety of large projected area parts, Model "6" will plasticize up to 60 pounds of material per hour . . . mold 7-ounce shots of polystyrene at the rate of 2½ per minute.

An exclusive feature of the LEWIS "6" is the new HYDRA-LOCK clamp . . . the safest, most powerful mold clamping mechanism available today. HYDRA-LOCK utilizes only a cupful of oil to develop a 200-ton clamping pressure in tenths of a second. In addition, its design facilitates quicker, easier mold setting procedures.

For that all-important competitive advantage of high-speed low-cost production . . . specify the LEWIS "6" injection molding machine. It's engineered for demand performance.

1570-LW

Write for Bulletin 102 for complete details.

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They needed a tough plastic to make big moldings at low cost

Molder: General American Transportation Corp., Chicago, Ill.

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Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	"High Impact," Lowest Water Absorption Rate
MC-301	"High Impact" Improved Heat Distortion
MC-305	"High Impact," Easy Flow
MC-309	"High Impact," Highest Heat Distortion Temperature
MC-401	"Medium Impact," Improved Heat Distortion Temperature
MC-405	"Medium Impact," Easy Flow
MC-409	"Medium Impact," Highest Heat Distortion Temperature

• Westinghouse Electric wanted another liner for refrigerator doors—one that would be easy to clean, odorless, shock-resistant, and yet low in cost.

The molder, General American, suggested use of a liner made from a special, high-impact plastic. Koppers Modified Polystyrene MC-305 met the requirements, and is now used in several Westinghouse refrigerator models.

Koppers Polystyrenes, both regular and modified, have helped many manufacturers improve their products, and/or cut production costs. These plastics flow easily during molding, thereby reducing the molding cycle and increasing production. Our technical staff will be glad to assist you in selecting the specific Koppers Polystyrene that best fits your needs. Call or write your nearest Koppers office.

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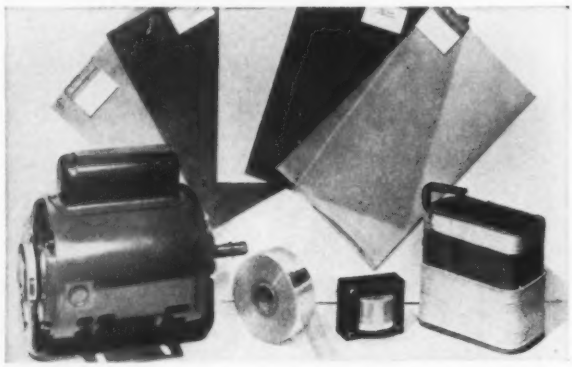
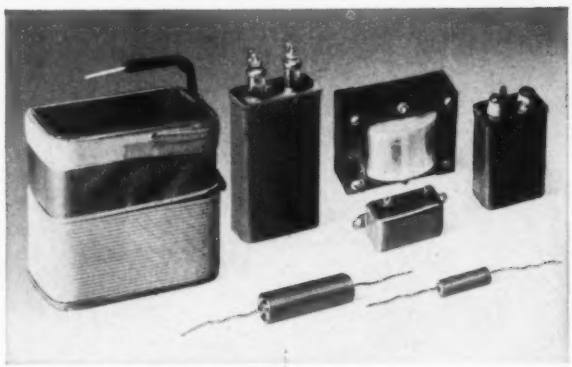
It's tissue-thin . . . yet strongest of all plastic films

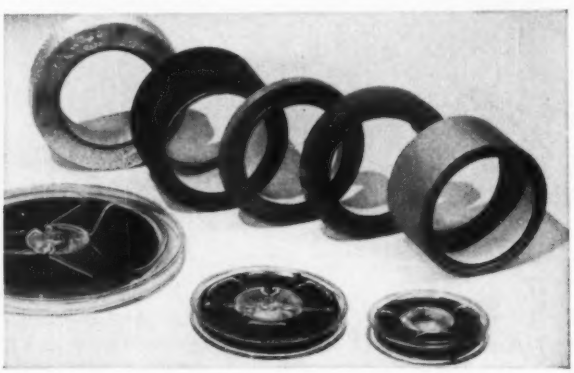


FOR LAMINATION, "Mylar" is tough, durable, chemically resistant . . . finding uses in combination with a wide variety of other materials.



FOR ELECTRICAL INSULATION, the balance of properties offered by "Mylar" permits insulation that takes up less space . . . resists extremes of temperature and humidity.

BONDED TO FOILS, "Mylar" makes a tough, brilliant thread for weaving into textiles . . . makes practical many new fabric designs.



AS A TAPE, "Mylar" offers high tensile strength . . . is dimensionally stable. It is being used for recording tapes and a variety of industrial tapes.

Out of Du Pont research comes a new film—"Mylar" polyester film—with properties so unusual that it can do an amazing variety of jobs. Many of its uses, in fact, are outside the fields where plastic films are now prominent.

"Mylar" has exceptional tensile and impact strength. Thus it can be made in gauges as thin as 0.00025 inch.

Electrically, "Mylar" has high dielectric strength and a relatively low power factor. These properties, together with its outstanding mechanical properties and thermal stability, make it ideal for a variety of insulating purposes . . . permit miniaturization of electrical equipment.

Tough, durable and greaseproof, "Mylar" can be used for industrial tapes . . . thermal insulation protection. It can be combined with foils, papers, plastics . . . opening new possibilities in the design of protective and decorative laminates and other materials.

These are only a few of the applications now being tested for this remarkable film. There's no question that you'll be seeing more of "Mylar"—and doing more with it—in the near future. Why not investigate its possibilities for *your* products right now? Write for further information to: E. I. du Pont de Nemours & Co. (Inc.), Film Department, Room M Wilmington 98, Delaware.

DU PONT "MYLAR"

Polyester Film

DU PONT

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

. . . stated Maynard Axelrod, President of

MAYNARD PLASTICS, Inc.

Four years ago Maynard Plastics, Inc., began extruding thermoplastics, operating as a Division of Novelty Bias Binding Co. Today they are a leader in the field of custom plastic extrusions.

"Actually we purchased two other types of extruders before buying our first NRM's," continued Mr. Axelrod. "We found the NRM's so versatile and dependable that we have since purchased four more."

Maynard Plastics' preference for NRM Extruders is typical of large and small plastics manufacturers all over the world. Where NRM Extruders are operated side by side with other makes, an overwhelming number of owners express their preference by *standardizing* on NRM.

Check *your* requirements for plastic extruding equipment with NRM, TODAY. Your postcard will bring full information on the only *complete* line of extruders and equipment. In it you'll find the right type and size of thermoplastic Extruders to do your work most accurately, efficiently and *profitably.*

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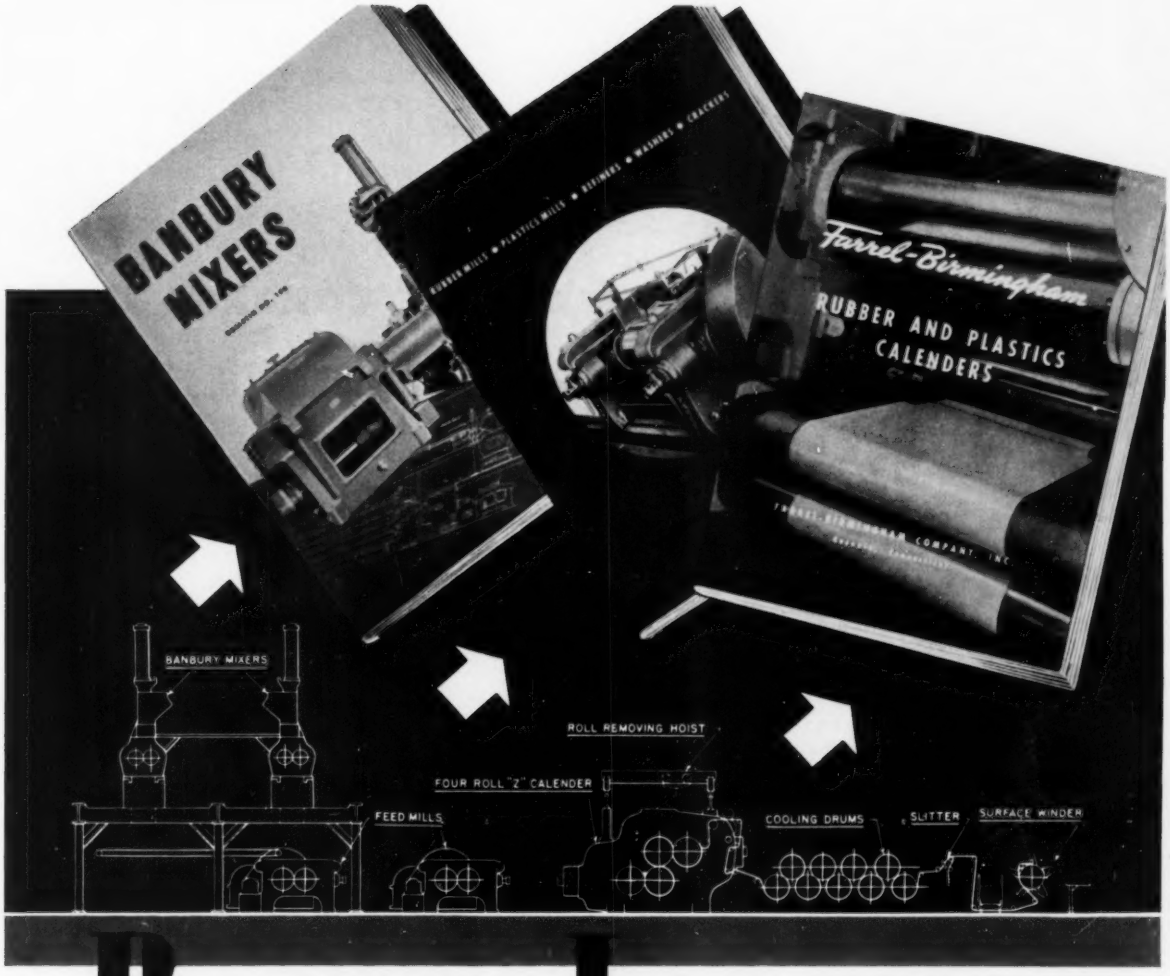

REFERENCE LIBRARY

for an efficient film production line

The three bulletins illustrated describe the major components of the processing setup blueprinted above. They contain details of the latest developments in processing methods and equipment, as pioneered by Farrel-Birmingham in the last few years, as well as illustrations, general specifications, information on related equipment and other pertinent data.

The processing setup is one of a number developed by Farrel-Birmingham to synchronize the progressive steps in the production of plastic film, sheet and coatings. These matched production units have given such satisfactory service that they have become generally accepted as standard equipment. For individual requirements, demanding greater or lesser output, larger or smaller machines with matched capacities are available.

Write for copies of these fact-filled bulletins today. There is no obligation.

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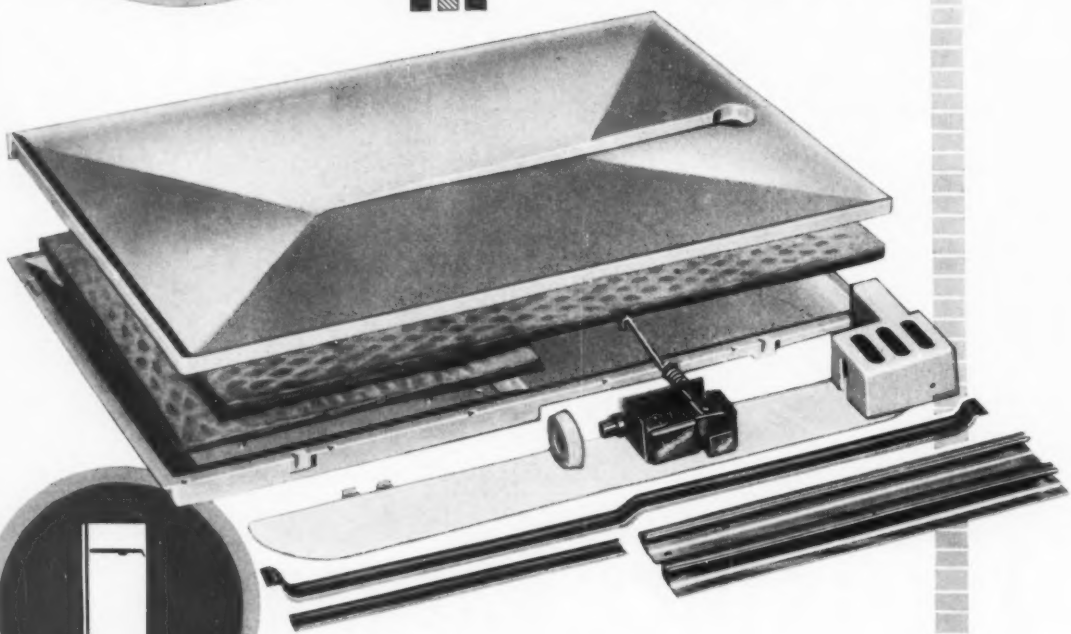

To maintain proper temperatures in both the freezing and regular cooling areas of their deluxe model refrigerator, the INTERNATIONAL HARVESTER COMPANY designed this revolutionary new Automatic Temperature Control Unit. It is equipped with a Verna-Therm power element which responds automatically to temperature changes in the regular cooling area and feeds cold air to it from the freezer when necessary.

After approval of the design, SANTAY took over complete production, assembly, testing and packaging of the unit . . . 37 component parts in all. All plastic parts are molded of polystyrene and stainless steel is used for the metal components. The upper and lower portions of the pan are sealed water tight. Finished parts are assembled into a complete unit which is tested under actual refrigerated conditions with dry ice. Each unit is then individually packaged, ready to be shipped with the refrigerator to the housewife who installs it herself. This *complete* service by *one* company, under *one* roof, insures strictest quality control and eliminates unnecessary handling at the customer's plant . . . clear reasons why customers get a *better* product . . . *economically* . . . at SANTAY.

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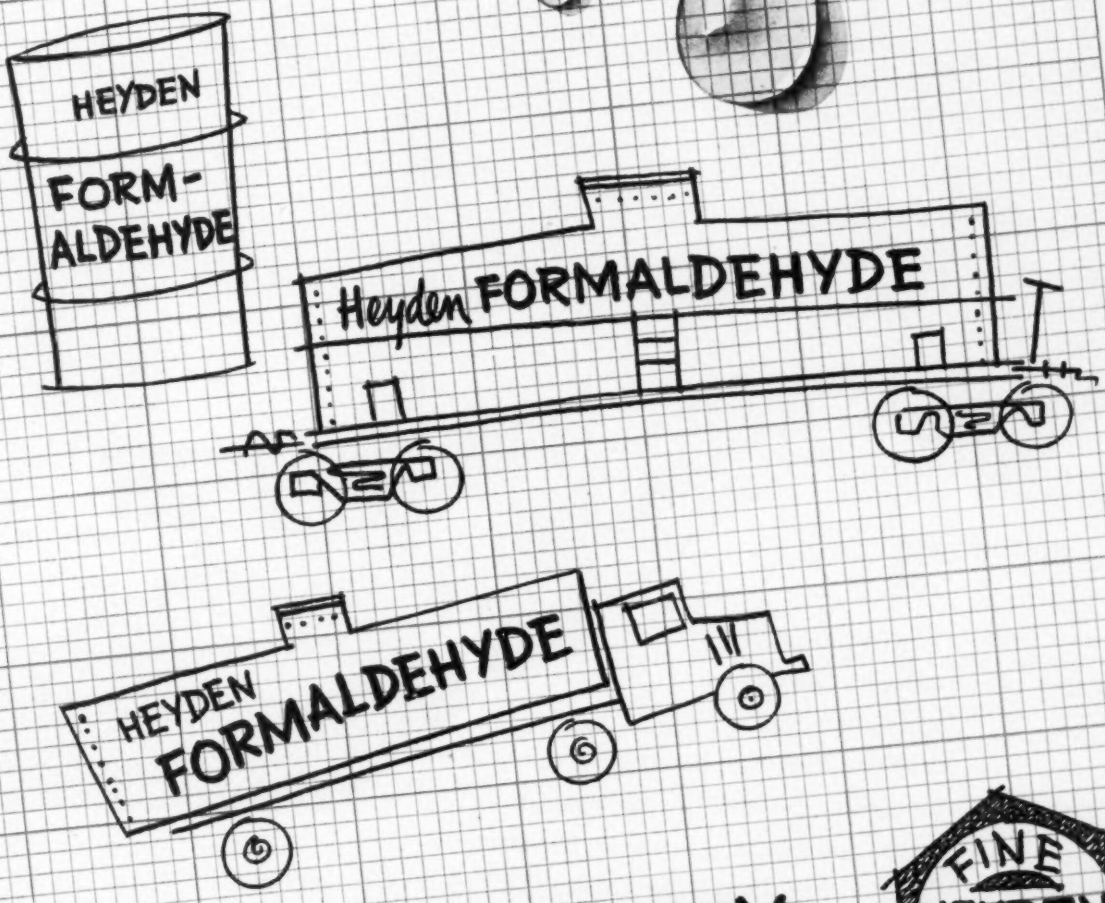

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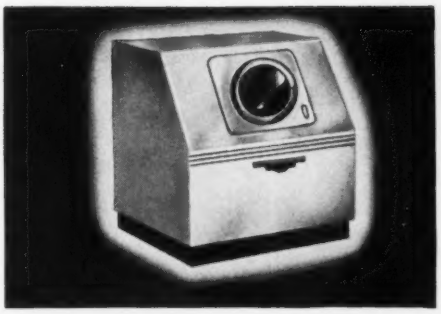
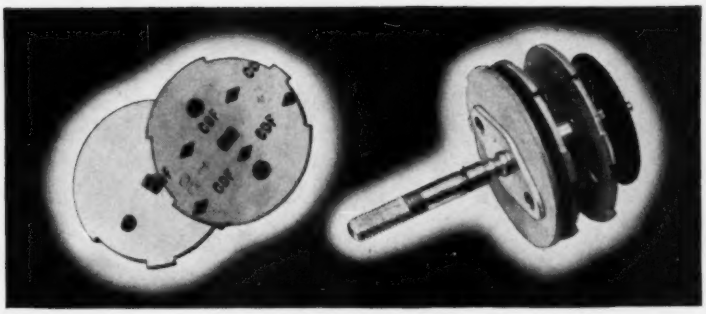
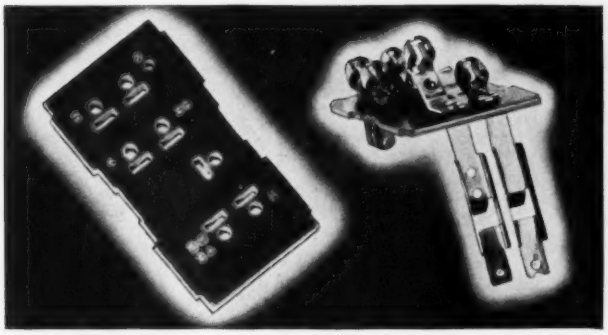


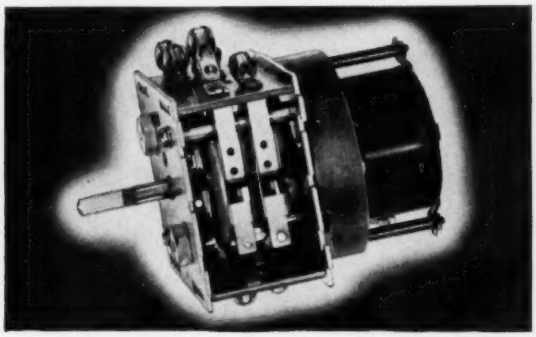
What makes the miracle of automatic washdays? What gadget turns water on and off; starts spinners, agitators, fans; regulates heat . . . all on a precise timing schedule? Chances are it's a P. R. Mallory timer switch.



Special paper-base Dilecto laminated phenolic cams are the heart of the switch. If the corners are not sharp, if tolerances are not held, if the laminated plastic fails, the timing schedule would go haywire. But it doesn't happen with Dilecto cams *fabricated by C-D-F*, now definitely identified for performance comparison.



C-D-F also supplies these Dilecto insulating side boards. Dilecto Grade X-13 was chosen for its ability to withstand severe riveting and staking impact, for its sturdiness in holding up under the strain of plugs being inserted and removed from terminals mounted on the board.



Look inside the smart, small, tough Mallory timer switch. The shaft revolves; with the switch operated by a manual clock which is wound or set whenever the switch is turned over to complete the entire cycle. *Switch accuracy depends entirely on the degree of accuracy in which the cam is manufactured.*

C-D-F and DILECTO® LAMINATED PLASTIC helped Mallory

improve design . . . simplify purchasing . . . speed production

Two C-D-F Dilecto laminated plastic parts play small but vital roles inside P. R. Mallory's timer switches used to control the washing, drying, rinsing cycles.

Most important, the timing cams must be precisely fabricated to odd, notched shapes, with very close dimensional tolerances. In the design stage, it was first thought that there was no practical way to obtain the desired pieces.

But engineering-supplier teamwork always pays off. Good basic design . . . a quality material from an alert, interested fabricator . . . selective purchasing resulted in a solution.

C-D-F WORKS WITH DESIGNERS

A father and son team, in Mallory's Switch Division, Arthur and Harry Hall, began 15 years ago to make this timer switch. Cam material after material was tested . . . none worked satisfactorily.

C-D-F sales engineer Robert Tappan was called in. He says, "After 18 months, the design was adaptable to Dilecto laminated plastic. The first cam did not work, but showed promise. Looking back, it was a crude punching compared to the ones now furnished by the C-D-F Valparaiso plant."

A BIG, RELIABLE SOURCE

Mallory makes thousands of timer switches, naturally has several suppliers for laminated plastic insulation. But C-D-F keeps working hard to further improve the product: Special tools have been designed to increase the accuracy of C-D-F cams, to provide Mallory with *lower rejection* rates. Resin-penetrating and laminating techniques have improved Dilecto grades. Inspection and quality control have been modernized.

When you have a problem in laminated plastics, think of improved, Dilecto and C-D-F. Send us your print for technical advice and quotation. Write for free test samples. The C-D-F catalog is in Sweet's Design File and the IRE Directory. Best of all, call your C-D-F sales engineer . . . He's a good man to know!

CDF *Continental-Diamond Fibre*

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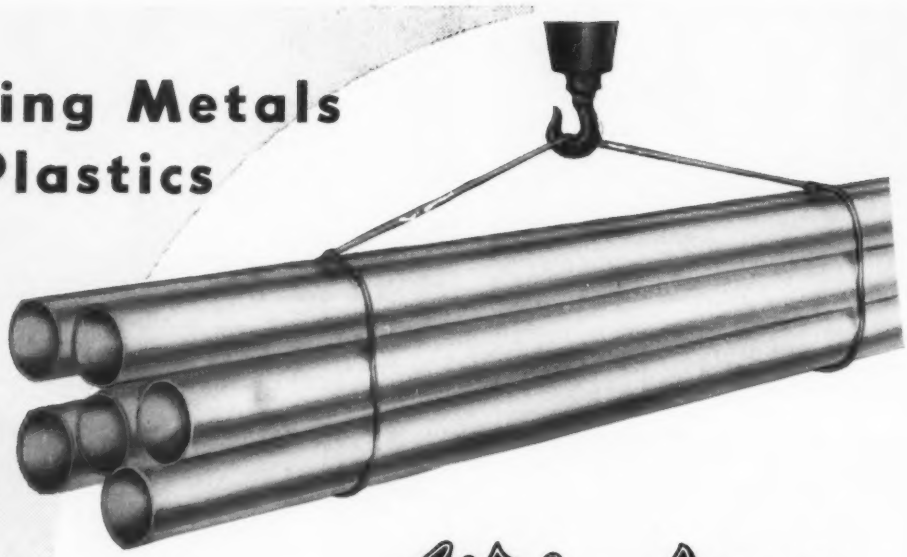
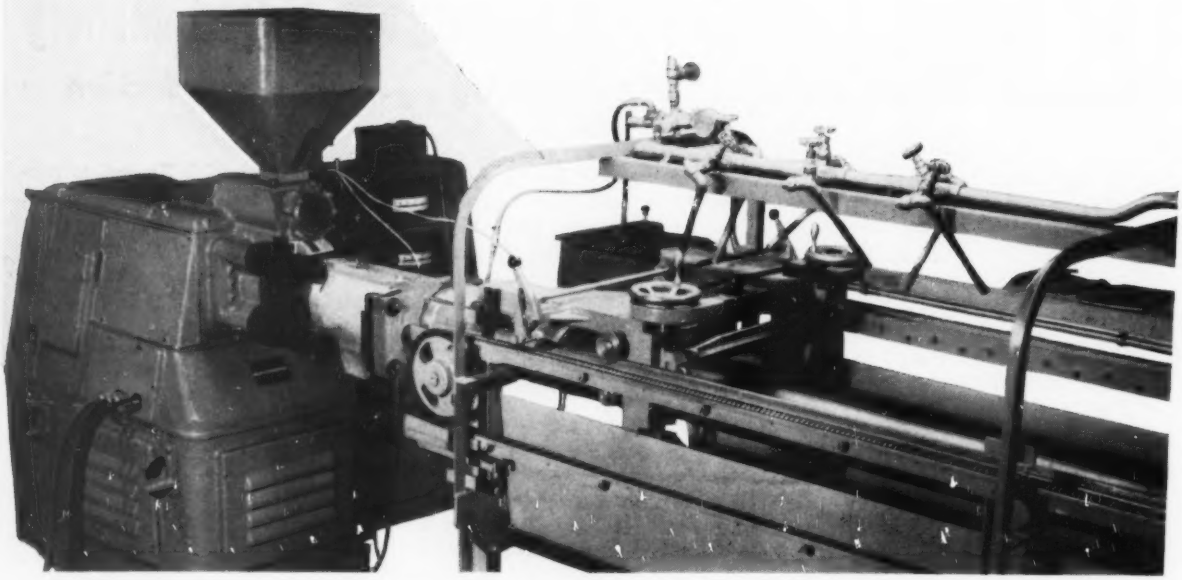


Produced on the Windsor

Industrial plastic pipe of both polyethylene and rigid unplasticised polyvinyl chloride are replacing metal pipes more and more. Plastic pipe has many advantages over metals, particularly for the chemical industry. In addition to its low cost and light weight it affords the opportunity to conserve metals. It is impervious to attack by most acids, caustics and other corrosives.

Leaflet with full specification sent on request.



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HOW FERRO'S "1203" SOLVES 3 PROBLEMS

for Organosol and Plastisol manufacturers

1. DEAERATION

To the right are illustrations made from actual test samples of a vinyl-paste resin using three different stabilizers. All samples were treated in exactly the same manner, but the differences are obvious. While air bubbles occurred using both stabilizer A and B, Ferro Stabilizer 1203 produced a sample entirely free of entrapped air.

(Test samples available on request)

STABILIZER "A" | STABILIZER "B" | FERRO STABILIZER 1203

2. VISCOSITY BUILD-UP

As is well known, many stabilizers contribute to viscosity increase of plastisols during storage. In No. 1203, Ferro introduces a stabilizer that not only does *not* contribute to viscosity build-up, but often acts as a viscosity depressant.

3. COPPER STAINING

Slush molders using copper molds are frequently troubled with discoloration due to copper staining. In the test at the right, new copper pennies were fused in the plastisol samples. Both stabilizer A and B showed bad copper staining, while Ferro Stabilizer 1203 produced perfectly colorless samples free of any copper stains.

STABILIZER "A" | STABILIZER "B" | FERRO STABILIZER 1203

DEVELOPED ESPECIALLY FOR PLASTISOLS!

Ferro Stabilizer 1203 is the product of two years' intensive research. It is a stabilizer developed *solely* for use in plastisols, to meet specific needs in the field. The tests shown above definitely prove Ferro's 1203 much superior to competitive stabilizers now on the market.

Write for samples and complete information. Let Ferro's 1203 solve *your* stabilization problems.

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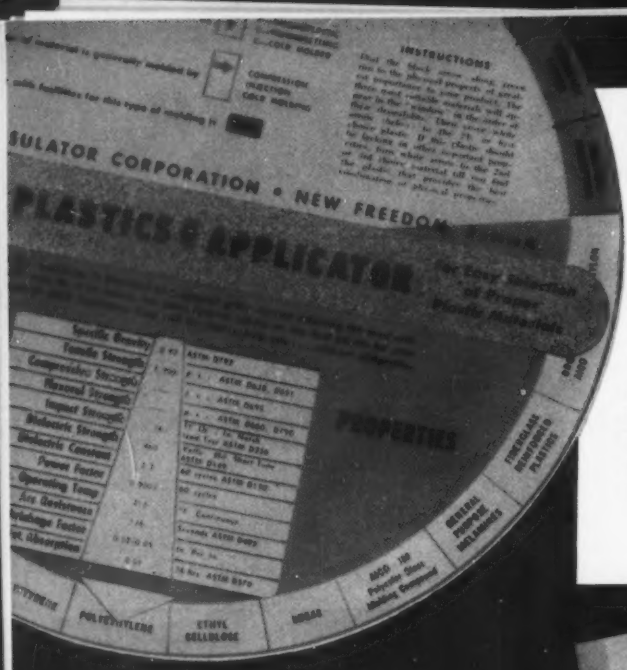

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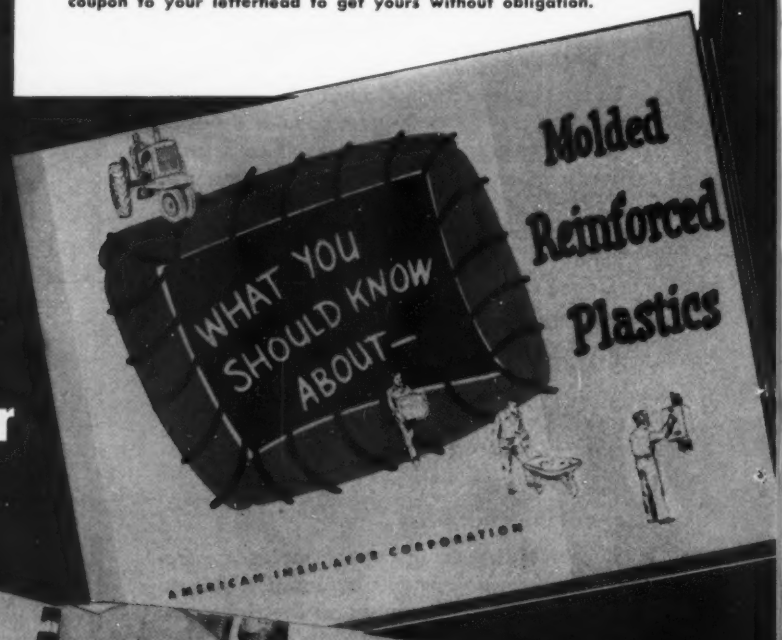

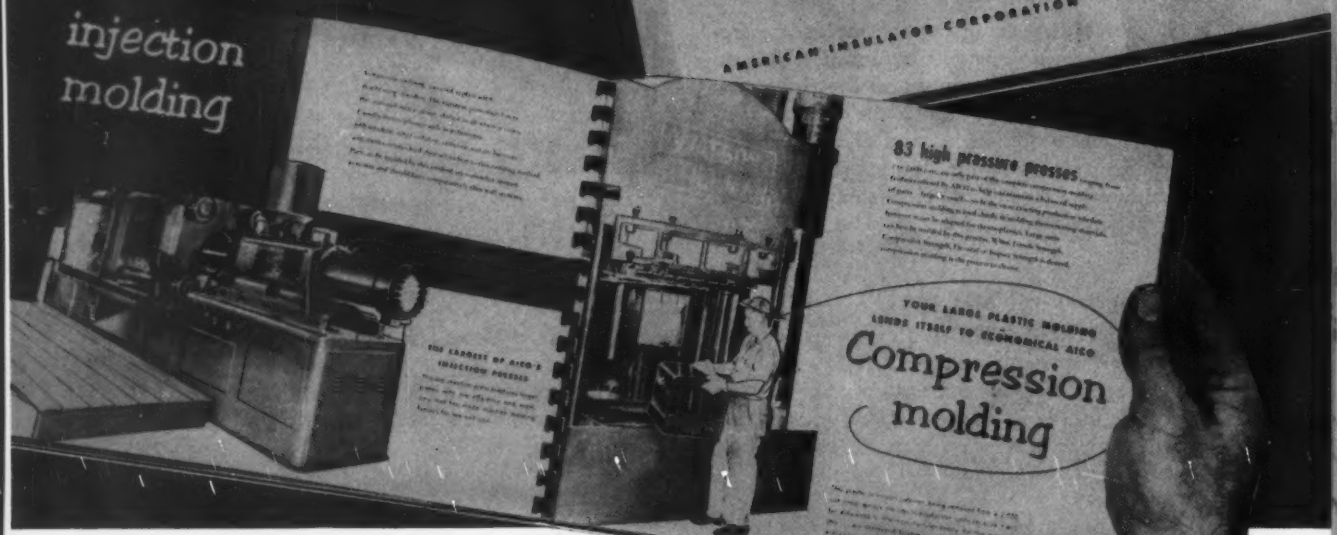
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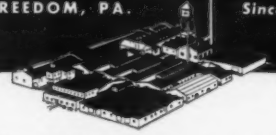


MANY THINGS ARE BETTER BECAUSE OF AICO MOLDED PLASTICS

MODERN PLASTICS

MAY 1954 VOLUME 31 NUMBER 9

At end of a relatively fast forming and cooling cycle, vacuum formed window display, preprinted in brilliant colors, is removed from a low-cost plaster mold. See also illustrations on next two pages

Courtesy Eimson-Freeman Co.

SHAPE A SHEET of any rigid thermoplastic by vacuum forming and gain the advantages of low-cost tooling, flexibility in design, large-area pieces, and early production

WITHIN the past five years, progress in vacuum forming of rigid plastics sheet has been spectacular —results even more so. Sales of sheet materials have skyrocketed. Long-established markets, which previously made use of plastics materials only in limited quantities because of cost and design considerations, have substantially increased their consumption. New markets in which plastics could never before economically compete have been opened . . . and, judging by growing interest, potential growth far overshadows present achievements.

Expanding Markets

As a result of the recent development of commercial vacuum forming machines and the introduction of better and low-cost rigid plastics sheet materials, manufacturers in many fields have become fascinated by the possibilities of the process. The idea of clamping a plastics sheet into the frame of a simple machine,

1 Production of three-dimensional window display begins with sculptor creating the plaster model

pulling a heater over the sheet, and then forming the sheet into any desired contour by vacuum-drawing it into or onto an inexpensive mold, has appealed to leaders in industries as diverse as toys and novelties, automobiles, signs and displays, refrigeration, television, packaging, lighting fixtures, and materials handling.

As a market for rigid plastics sheet materials, it is estimated that the vacuum forming industry consumed between 20 to 30 million lb. of plastics in 1953 and may go to 200 million lb. within 5 years. Improved techniques and equipment have made possible production jobs in which up to 300 lb. of plastics are consumed an hour—and even bigger production runs are predicted for the near future.

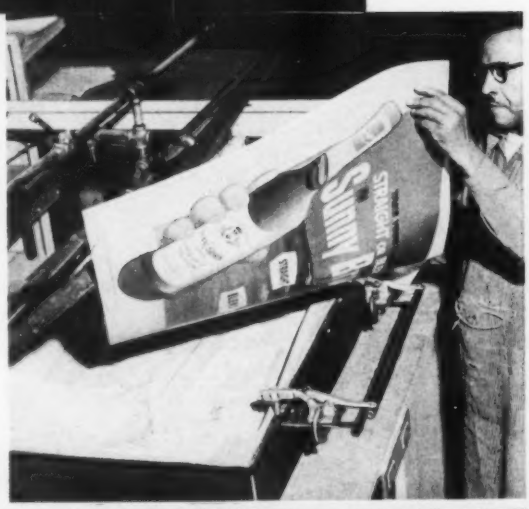
Cost and Time

There are many reasons behind the enthusiasm being shown today for the vacuum forming process by end-users and fabricators alike. Capital investment is low, equipment is adaptable to a wide variety of jobs, tooling and set-up times are low, and formed sheet parts can be designed to save time and money in assembly.

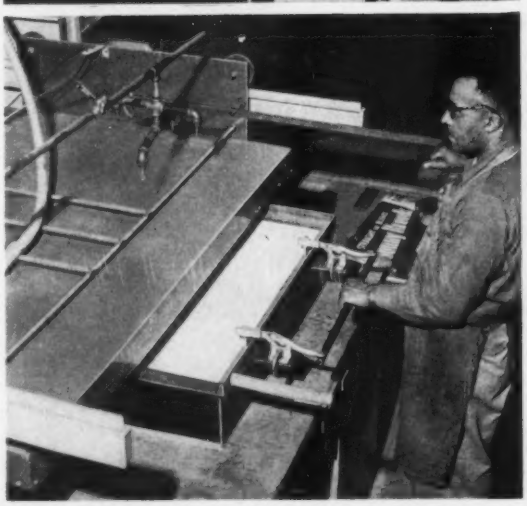
Vacuum forming fits into the heretofore unexploited void between injection molding and fabrication of sheet materials with expensive matched metal molds or by cumbersome machine-and-cement methods. As it expands, vacuum forming will, of course, overlap both fields. Many jobs will be taken over that can be done faster, cheaper, and better by vacuum forming than by injection molding; on the other hand, vacuum forming cannot compete with injection molding in a multitude of jobs where complexity of design rules out simple forming.

In many interviews with both vacuum formers and injection molders it was indicated that, while it will take away some business from the molders, vacuum forming will find its most important applications as a supplement rather than as a competitor to injection molding.

It appears, then, that the future



2 Final female mold made from plaster model is mounted on mold platform of vacuum forming machine and a sheet of vinyl printed in distortion is clamped on top of it



3 Heater is then manually pulled forward over the plastic sheet. After being heated at 700° F. for about 15 sec., the softened sheet is pulled by vacuum into the mold

of vacuum forming lies in that area of application where molding and fabricating of plastics and other materials have proved too costly and inflexible—and hence have discouraged extensive use of plastics. It is in this area that vacuum formed plastics parts will find their most profitable outlets as replacements for metal stampings, papier mâché, plywood, and other tough and formable compositions.

ADVANTAGES AND LIMITATIONS

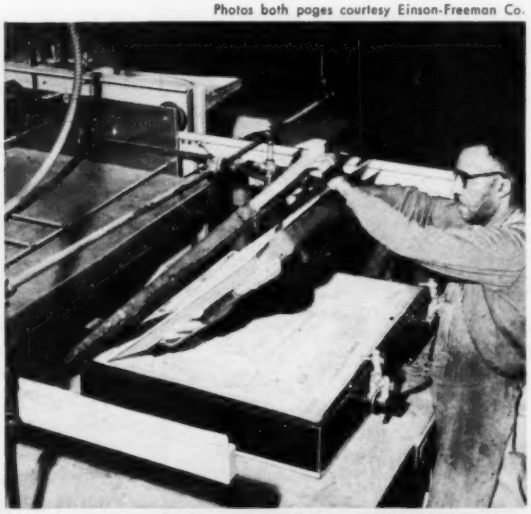
Vacuum forming is a field of extremes where production runs as high as 60 million pieces and as low as 30 pieces can show a profit on the same machine. Between these extremes is a wide range of possibilities, many of which are yet to be exploited.

In comparison to other plastics molding and fabricating operations, the low cost of equipment and tools for vacuum forming gives the new process a decided edge. Thus, a complete commercial vacuum forming machine sells from about $5000 to approximately $9000. The cost of operation of such a machine is about $5 to $9 an hour. Mold costs run from as low as $30 to $40 a sq. ft. for a plaster mold to $200 a sq. ft. for a metal mold.

Because of low equipment cost, one manufacturer of Christmas displays claims that switching from injection molding to vacuum forming cut final costs of producing a typical Santa Claus figure exactly in half. Another manufacturer, supplying the refrigeration industry, was able to set up a complete mold for forming a small door panel at a cost of only $1250.

Even in competition with wood or metal fabrication, vacuum forming can come out on top. One manufacturer on the East Coast, for example, replaced steel machine safety guards with guards formed of Royalite styrene copolymer sheet. The steel guards cost him about $15 each; the vacuum formed parts, $6.50.

Photos both pages courtesy Einson-Freeman Co.



4 Heater automatically rolls back at end of cycle and the formed sheet is cooled by air blasts. The distorted design falls into register now that display is formed

5 After a cardboard support has been attached to the back of the formed sheet, finished piece is ready for use in store windows as an inexpensive, eye-catching display

Long vs. Short Runs

Since plastics sheet materials sell for about 1½ to 2 times as much as plastics molding materials, the economic advantages to be derived from the low initial costs of vacuum forming equipment are determined to a large extent by the length of the production run. Vacuum forming is, of course, the ideal solution for the manufacturer who is anxious to utilize the properties of plastics materials but whose short production run is inadequate to amortize the cost of an injection mold.

At the same time, however, a point is reached in a long production run beyond which the higher price of plastic sheet coupled with the low cost of vacuum forming equipment begins to add up to more than the combined costs of injection molding equipment and materials. This point varies according to the size of the part. Small pieces can be economically vacuum formed in runs that go as high as 250,000 units. For many larger pieces, 25,000 to 30,000 units are considered to be the maximum economical run.

It must be pointed out here that, on *very* small and simple pieces, such as dome-like "blister" packages, these figures do not apply. Using molds with as many as 800 cavities, such pieces can be economically produced by vacuum forming in runs that go well into the millions.

On a job being done by Majestic Creations, Woodside, N.Y., for example, 6 million parts a week were vacuum formed at a profit. The parts were small hemispherical cups which are filled with oil paints by Palmer Paint Co., Detroit, Mich., and marketed together with predrawn sketches as a "paint-by-number" kit. An 810-cavity alumi-

num mold was used and the cups were formed in a 10-sec. cycle from a 22- by 52-in. sheet of 0.015-in. vinyl material.

Thin Sections

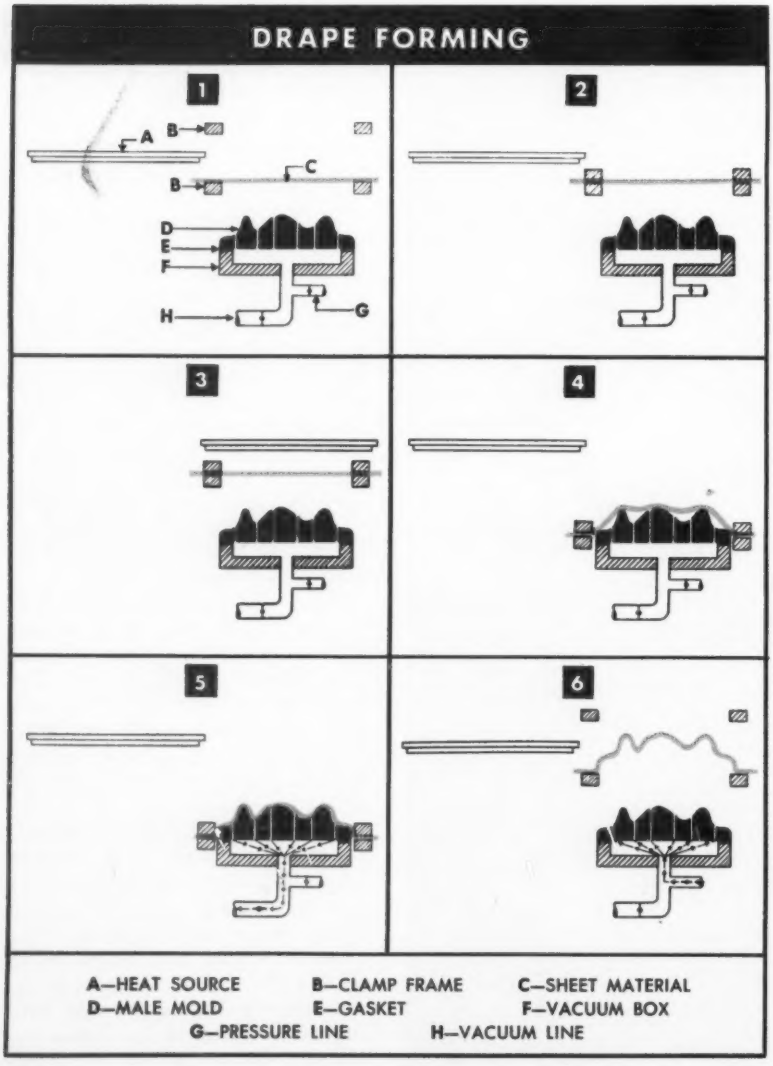
Vacuum forming is more adaptable to the mass production of thin, broad-area objects than is any molding process. It would be virtually impossible to injection mold the many parts with wall sections of less than 0.030 in. that are being vacuum formed.

At the same time, one of the major limitations in the use of vacuum forming is complicated interior piece design, particularly where varying wall thicknesses, undercuts, and molded-in inserts are requirements.

Compared to conventional plastics and sheet metal fabrication methods, vacuum forming comes out on top. Plastics sheet fabricated in matched metal molds are usually restricted in design to round, square, oval, or other regular geometric patterns. Stamped metal applications do not have the flexible design potential of a vacuum formed piece, and are difficult to handle.

A container for a cake decorating set currently being sold to commercial bakers, points up the design potential of the vacuum forming process. The original container, a product of August-Thomsen & Co., Brooklyn, N.Y., was fabricated of

Vacuum Forming



THE five basic essentials of a vacuum forming machine are the heat source, vacuum equipment, the clamping frame, the mold platform, and the mold.

In most of the standard commercial machines available today, these essentials have been effectively combined into a single unit that can be automatically cycled for high-speed production. The vacuum forming machine, as discussed in this article, differs from other forming equipment in that the sheet is heated in position on the mold instead of being separately heated in an oven, and in that no external pressures in the form of punches or overhead molds are used.

There are two types of vacuum forming machines currently on the market—drape forming and straight vacuum.

In drape forming, used primarily with male molds, the plastics sheet is clamped into a movable frame. The heater, which may be an infrared heating panel, a radiant heating panel, or a strip heater, is then rolled forward until it is directly over the sheet.

As the sheet heats, it drapes down onto the high points of the male mold. At the end of the heating cycle the clamp frame drops down and clamps the sheet tightly around the periphery of the mold. The heater is then retracted and vacuum is drawn, pulling the sheet tightly against all surfaces of the mold.

After cooling, the clamp frame

metal and consisted of a cover, base, and a series of thin metal sheets which formed pockets for the ornamenting dies. Assembly was slow and the sharp edges of the metal necessitated the inclusion of a small rubber handle with the set to enable the user to remove the dies without danger of being cut.

By switching to plastics sheet, vacuum formed by Auburn Button Works, Inc., Auburn, N.Y., a neater-looking, easier-to-clean, and more functional box was produced. A series of matching projections formed into the base and lid provide a snug fit for the dies when the lid is closed and facilitate selection and removal of the correct die.

The base of the container is 0.060- to 0.080-in. styrene; the cover is 0.040-in. translucent butyrate. To produce the container economically, Auburn Button Works constructed a eight-cavity mold consisting of four female cavities for the lid and four for the base. A sheet of styrene and one of butyrate are placed side by side over their respective cavities. By screening out part of the heater so as to deflect heat from the thinner sheet of butyrate, the two parts are formed simultaneously on the same cycle.

Speed of Production

The speed with which a vacuum forming job can be tooled up is a major advantage of the process. Av-

Equipment and Methods

raises, thereby pulling the formed sheet away from the mold. In some cases air pressure is used to aid the parting. The clamp then opens and the formed sheet is removed.

On some of the equipment available today, the heater is manually pulled forward over the sheet. As the heater reaches its fully forward position, it trips a relay which starts the balance of the functions in automatic, timed sequence. In other equipment, the entire operation is automatic from the time the sheet is manually placed in the mold clamp.

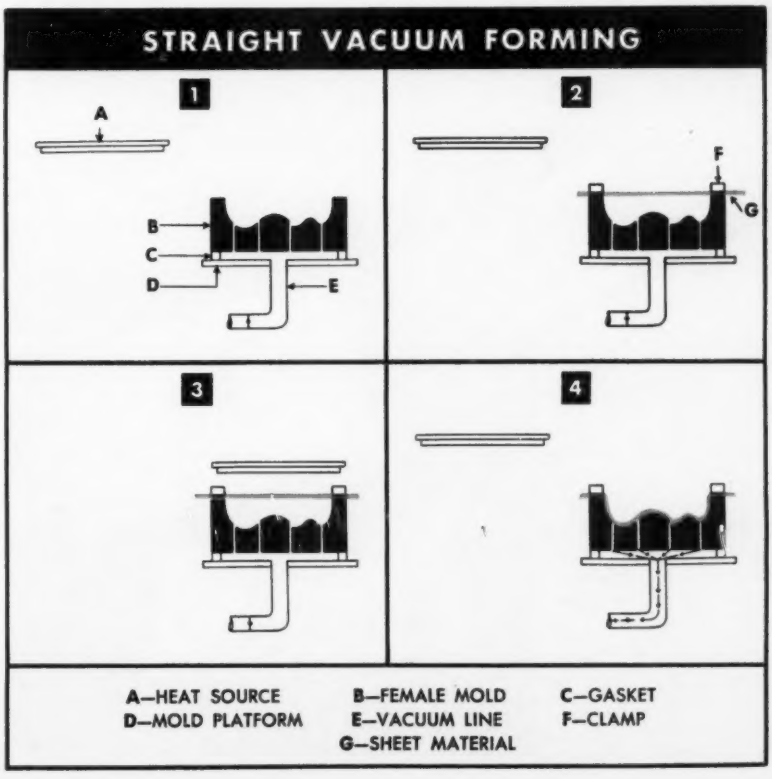
On straight vacuum equipment, the plastics sheet is clamped in a stationary frame and is vacuum-drawn directly into the mold. Straight vacuum is used primarily with female molds. In other details, such as heating, forming, cooling, and automatic cycling, straight vacuum equipment is similar to the drape forming equipment.

Distance of the heater from the sheet, the amount of heat, and the heating time vary, depending upon the type and gage of material used, equipment, etc.

Many vacuum forming machines today make provision for either straight vacuum or drape forming. Many machines are also double-bed units in which the heater rolls back away from the first sheet after the vacuum has been pulled and into position over a second plastics sheet clamped into a frame on the opposite side of the machine.

The three leading manufacturers of vacuum forming machines in the United States today are Auto-Vac Co., Fairfield, Conn.; Vacuum Forming Corp., Port Washington, N. Y.; and Industrial Radiant Heat Corp., Gladstone, N. J. A progressive manufacturer of vacuum forming machines in Europe is Hydro-Chemie Ltd., Zurich, Switzerland. Two recent entries to the manufacturing field are Tamco Industries, Inc., Huntington Station, N. Y. and Radiant Heat Corp., Providence, R. I.

Some work has been done by various fabricators such as Gregstrom Corp., Cambridge, Mass., in custom-building their own machines to perform specialized jobs.



Die-cut elements in nursery scene printed on cardboard (background) can be replaced by vacuum formed parts snapped out of styrene sheet and then hand painted

erage delivery time for a plaster mold is from 3 to 10 days, for a sprayed metal mold from 1 to 3 weeks, and for a plated mold from 3 to 5 weeks. For the small refrigerator door panel mentioned above, molds were ready and the panels were in production 4½ weeks after the first blueprint was received by the vacuum former.

A case study in vacuum forming from Gregstrom Corp., Cambridge, Mass., further illustrates speed of production. Twenty-five thousand units of a novelty combination plastics coaster and ash tray set were needed . . . in a hurry! Tooling began on the same day that the order was received. Samples were ready within 5 days and the coaster set was in production within a month's time at a rate of 42 formed coaster sets every three minutes. The operator was freed by the automatic cycling of the machine to do the rough trim. The most time-consuming operation was attaching metal legs to the coaster.

Translucent plastics sheet lit by bulb in housing makes excellent tracing surface

Courtesy Chicago Molded Products Corp.

Housing is formed in one piece from sheet of styrene copolymer. Clips that hold flat sheet in place are also vacuum formed

Market Research

Because of the speed and low cost with which a vacuum formed job can be put into production, market research and testing can be done quickly by running samples on inexpensive sample molds prior to actual production.

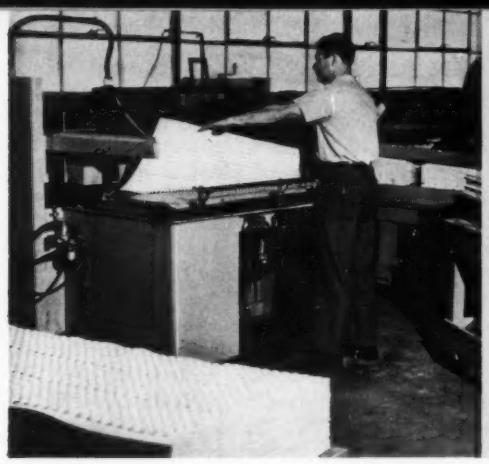
In industries such as toys or novelties, where markets and consumer reactions can never be accurately predicted, this means that several sample products can be put on the market within a matter of days to test consumer reaction. The manufacturer can thus safely decide on the potential for his product before investing in an expensive production set-up—and still hit a market while it is "hot."

Since initial molds are usually made of plaster or wood, they can be modified as design changes are required without necessity of making a new mold for each change. When design is proved satisfactory, a permanent mold can be made from the final working model.

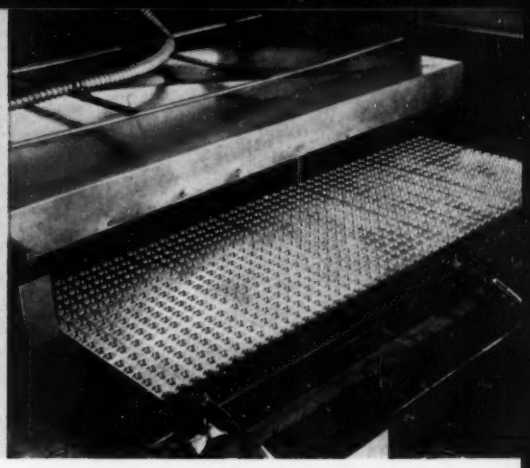
For industries where styles change week by week, this flexibility facilitates quick change-over in design to meet new trends, thus eliminating need for heavy capital investment in any one style.

Finishing Operations

Vacuum formed pieces can be decorated either before or after forming, but substantial cost savings can often be made by preprinting the plastic sheet in distortion and then forming it so that the colors register in position. A Santa Claus display previously produced by injection molding (where predecoration is impossible) cost $2 to mold and 17¢ to paint after molding. By preprinting the sheet, a similar



Using an 810-cavity aluminum mold, hemispherical cups for a "paint-by-number" kit are formed in a 10-sec. cycle. About 6 million units a week can be economically produced



Courtesy Majestic Creations

vacuum formed Santa was produced at a total cost of $1—and no extra finishing operations were required.

In preparation for preprinting in distortion, an uncolored piece is formed to shape and appropriately colored. The formed part is then put back under the heater and brought back to the original flat sheet condition. This sheet is then tested for registration and the process is repeated until the correct distortion has been achieved. The final distorted picture on the flat sheet is used to make silk screens or lithographic plates.

For silk screening, which is usually recommended for short runs, costs are as follows: screens, $20 to $30 per color on a sheet 20 by 25 in.; screening operation, 3¢ per color; paint, about $7 to $12 per gal. or 1¢ per sq. foot.

For longer runs with a minimum of 7500 to 10,000 sheets, printing by lithography is recommended. Plate costs run from $75 to $150 a color. An 8-sq. ft. sheet costs 4¢ a color to run on a litho press.

Finishing effects other than coloring can also be applied in distortion and then formed into register. Velvetone Finishing Corp., Long Island City, N.Y., for example, has developed a technique for flocking the red uniform of a Santa Claus display while it is painted in distortion on a flat sheet. When the display is formed, the flocked parts, as well as the printed colors, fall into register.

MATERIALS AND METHODS

As described on pp. 90-91, the techniques of vacuum forming are simple—perhaps deceptively simple. Like any manufacturing process, the secret of success is in the sound selection of the right equipment for the right job.

Although still a relatively new process, there is already a wide range of materials and machines available for vacuum forming. The prospective user must make his selections on the basis of specific results, without concessions that might result in an inferior product.

Thermoplastic Sheet

Theoretically, any rigid thermoplastic sheet can be vacuum formed. Because of cost, physical characteristics, and possible applications the vacuum forming market has been pretty well divided between styrene, vinyl, acetate, butyrate, and acrylic. According to current estimates, styrene and vinyl account for more than half of the rigid sheet being used, with acetate and butyrate sharing most of the rest. Acrylic sheets—traditionally fabricated in thicknesses over ¼ in. by such techniques as free-blowing and vacuum snap-back—are creeping into the vacuum forming field in thin gages from 0.060 to 0.080 inch. Forming of flexible thermoplastic sheeting, particularly flexible vinyl and polyethylene for upholstery, coasters, place mats, etc., is not discussed in this article.

The chart between pp. 90 and 91, as compiled by MODERN PLASTICS magazine, lists current sources of vacuum-formable rigid thermoplastic sheet.

It is recommended that the prospective user check with suppliers before making any decision as to materials. The many factors involved in a vacuum forming job,

Doll faces are vacuum formed in multiple units and then die cut

such as the type of mold, type of heater, type of machine, etc., preclude the possibility of any blanket statement as to the advisability of using any one material.

Molds

Because of the relatively low pressure involved in vacuum forming, a wide selection of low-cost molds is available. These include plaster molds which cost about $35 a sq. ft.; wooden molds that can be made with simple carpentry tools; sprayed metal molds that cost about $90 a sq. ft.; and plated metal molds that cost up to about $200 a sq. foot.

For comparatively short runs of 10 to 500 pieces, the molds can be

. . . Most Thermoplastics Can be Used

made from wood, plaster, or plastics. Mold material for medium runs up to 10,000 pieces can be plastic, sprayed metal, or low-melting alloys. Large production runs of 10,000 pieces or more usually require more durable molds such as sprayed metal, or machined, engraved, cast, or hobbed metal molds.

These recommendations set up no hard-and-fast rules. Many cases have been reported in which a reputedly short run mold has been used far past the 500 piece figure; many so-called medium run molds have successfully invaded large production jobs. One large plaster mold is still in operation after producing 50,000 pieces.

Plastics Molds

Provision must be made for uniformly cooling the mold after the part has been formed. Metal molds can be cooled by incorporating coolant channels; blasts of compressed air or sprays of cold water can be used for cooling other molds.

Research on improvement of molds for vacuum forming is a continuing project. Much work has centered around the use of cast plastics resin molds.

Phenolic casting resins have long been popular in the vacuum forming industry. A plaster mold is first made of the model and the liquid resin is poured into it. After curing and cooling, the phenolic mold is easily separated from the plaster mold. The phenolic mold duplicates the most intricate details of the plaster model and represents a tremendous savings in tooling costs. The Marblette Corp., Long Island City, N.Y., and Wal-Mar Plastics, Inc., Torrance, Calif., are among the suppliers of this type of resin.

Epoxy resin molds are a more recent addition to the field. Since the basic requirement for a vacuum forming mold is a smooth surface—the formed piece is quick to pick up any defect in the mold—epoxy resins were originally used to coat wooden and plaster molds to hide any grainy, irregular surface.

A great deal of experimentation is now being conducted, however, on the possibilities of molds cast from epoxy resins supplied by Bakelite Co., Shell Chemical Corp., and Ciba Co., Inc. Vacu-Form Corp. of America, Brooklyn, N.Y., makes use of an aluminum-filled epoxy resin. A mold of this type is claimed to be capable of reproducing detail, retaining a glossy surface, and withstanding thermal shock. The resin is also used by Vacu-Form to bind together aluminum cavities in multiple-cavity molds.

Metal Molds

Like so many other phases of the vacuum forming industry, the manufacture of all-metal molds has developed into a science designed to meet the industry's needs.

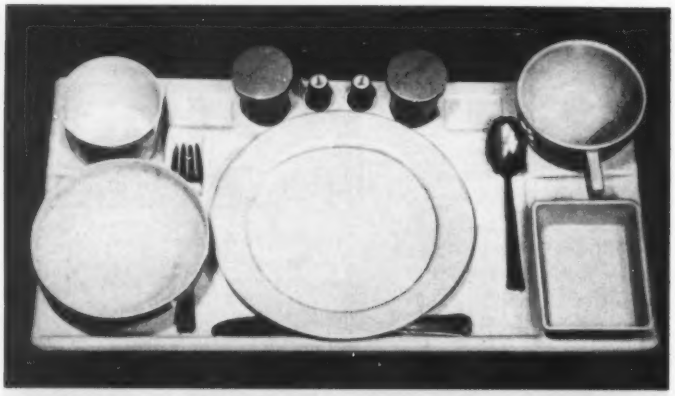
Victory Mold & Die Co., New York, N.Y., for example, makes available a low-cost, thin-wall cast metal mold. These shell castings are designed for use in long production runs and impart a glossy surface to the formed parts. The drape and vacuum molds are now being produced with water cooling coils incorporated in the mold walls. The molds are light in weight and have no depth or size limitations. Molds are cored in the back.

Sprayed metal molds consist of a metal shell backed up by other materials such as plaster, reinforced plastics, dental stone, etc. According to Metalmold Forming Co., New York, N.Y., one supplier of this type of mold, sprayed metal molds are economical, easy to make from any type of model, will pick up hair-line details, and require no additional finishing or chasing once they are made. Metalmold supplies a complete unit, consisting of a sprayed metal shell backed up by cast epoxy resin. Molds are supplied with vacuum holes already drilled.

Trimming

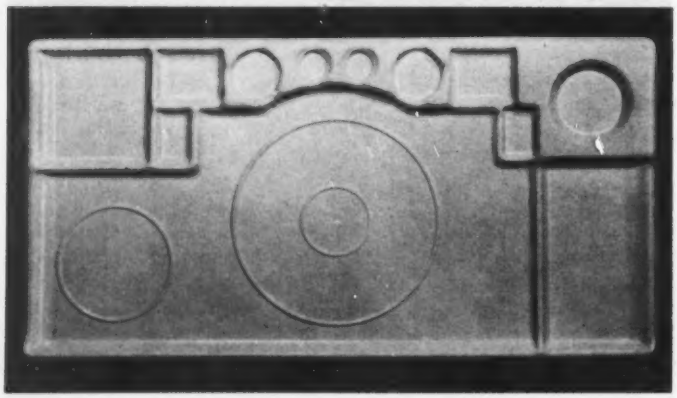
Since vacuum forming leaves a flange or waste edge on every piece that is formed, trimming is a special problem.

As the industry is set up now,



Courtesy Northern Industrial Chemical Co.

Food tray for airline service is vacuum formed from styrene copolymer sheet with contoured depressions to hold dinnerware and utensils



most of this work is done on punch, dinker, clicker, or crank presses with the use of high dies. Punch and clicker presses are most commonly used to separate a gang of identical parts on a single sheet. Dies for this operation run in cost from $10 to $500 each, depending on shape. Power shears, band saws, milling machines, and hand shears also come in for their share of use.

The need, however, is still for a cutting machine especially designed for trimming three-dimensional objects . . . and industry rumors indicate that such equipment is going to be available in the very near future.

APPLICATIONS

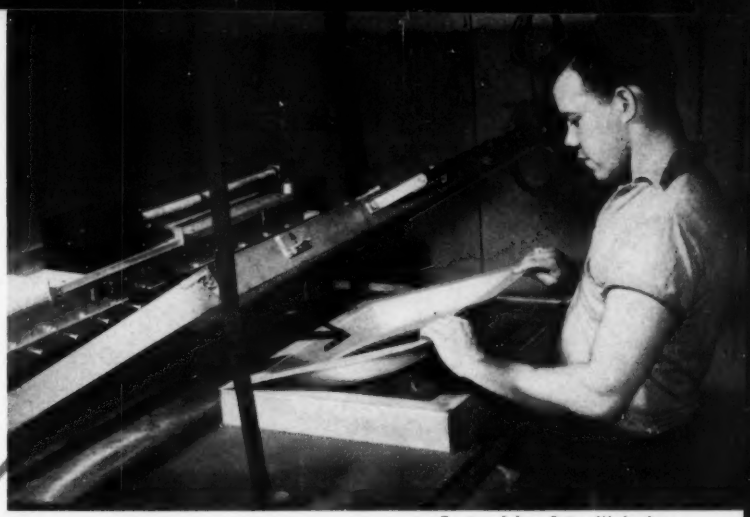
Present application possibilities of vacuum forming run the gamut from parts for heavy household appliances to tiny transparent "bubble" domes designed to lend selling appeal to card displays.

To illustrate the wide scope of vacuum forming—but by no means to list all possibilities—the following examples in major end use categories are described.

Packaging

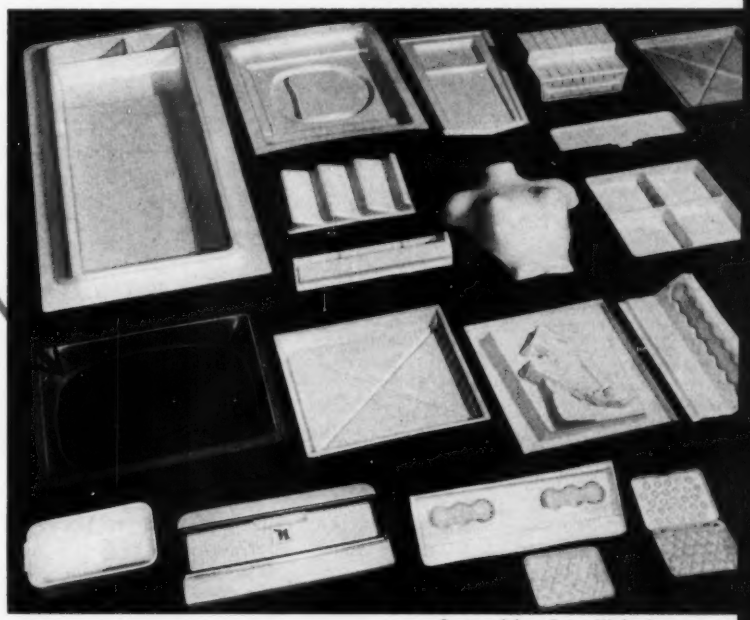
Probably the greatest potential for vacuum forming lies in the packaging field. One manufacturer estimates that from 60 to 100 million containers are now on order, with many more millions already produced and in use. Vacuum forming is particularly applicable to the manufacture of economical transparent containers that fit ideally into the gap between low-cost film wrap or bags and expensive molded containers.

A recent development that has attracted much attention in the packaging industry involves multiple linked containers formed to contour. Golf balls, for example, have been attractively packaged in this way.[1] Connected hemispherical cups are first formed in a sheet of trans-



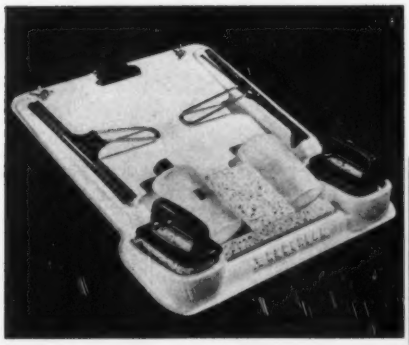
Courtesy Auburn Button Works, Inc.

Because of the need for thin wall sections in TV masks and because TV styles are subject to rapid change, nearly all TV masks today are being vacuum formed

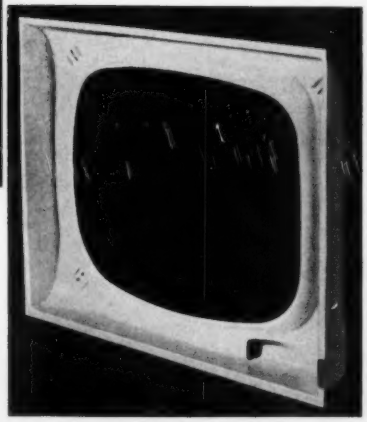


Courtesy Auburn Button Works, Inc.

In addition to TV masks, popular applications for vacuum forming include refrigerator panels and trays, displays, various industrial components, and packages



Vacuum formed tray for film developing unit provides convenient space for squeegee, sponges, and bottles



Courtesy Chicago Molded Products Corp.

Formed one-piece TV mask includes depression into which neon tube fits

[1] "Sales Appeal for Golf Balls," Modern Plastics *31*, 97, (Sept. 1953).

Courtesy Gregstrom Corp.

Vacuum forming is as adaptable to the production of Santa Claus faces, measuring 18 by 14 in., as it is to the larger Christmas displays (foreground). Faces are produced at the rate of 700 per hr. on the 12-cavity mold shown on machine

parent acetate. The golf balls are placed in the cups, a second sheet similarly formed is placed over them, and the two shells are electronically sealed together, thus providing individual packages. Christmas tree bulbs and razor blades have also been packaged in this fashion.

A similar job is done by Merit Displays, Paterson, N.J. This company packages a number of products—ranging from hardware items to ball point pen cartridge refills—by inserting them in transparent acetate containers vacuum formed to the exact shape of each item and then mounting container and product on a printed merchandising card.

Another manufacturer, Master

Vacuum formed package inserts, either transparent or opaque, are shaped to the contour of the packaged item to provide a snug fit

Courtesy Fabri-Kal Corp.

Improved techniques and improved materials for vacuum forming have made possible closer attention to detail and color register in displays

Courtesy Borkland Mfg. Co.

Rule Mfg. Co., Middletown, N.Y., has effectively opened a new phase in "blister" packaging by encasing a steel tape measuring rule in the package during the vacuum forming operation. The rule itself is actually used as the male mold and a 0.010 in. thick sheet of cellulose acetate butyrate is drawn down over 25 rules at a time to form a skintight sheath. Total cost is 25% less than that of the package previously used.

Re-usable containers, formed to the contours of the packaged merchandise, are another profitable packaging market for vacuum forming. Fabri-Kal Corp., Kalamazoo, Mich., for example, forms hardware packages along these lines. The base of the package is vacuum formed of thin Royalite styrene copolymer sheet with depressed shapes into which fit knives, handles, and scissors. A transparent formed butyrate cover completes an eye-appealing display piece.

Specialty Items

Vacuum forming is also suitable for the production of tray inserts for box or carton assorting. The A. C. Gilbert Co., New Haven, Conn., in their line of games uses such a formed acetate insert to replace colored chipboard platforms. Since each insert is formed to the shapes of the many parts that comprise the game, the parts are not haphazardly strewn about in the box. Also, the need for a conveyor system to pin each part in place on the cardboard platform is eliminated. Aluminum molds are used for the production job and approximately 3000 trays are turned out a day on one double-bed machine.

Another popular use of vacuum forming is in the production of clear acetate or butyrate "blisters" to brighten up display cards. These blisters, which can be easily cemented to the cards or inserted in openings die cut in the cards, are being produced by the hundreds of thousands in multiple-molds.

Vacu-Form Corp., of America, for one, uses a 390-cavity mold, consisting of female aluminum cavities cast into a special aluminum-filled epoxy resin.

Decorations

Vacuum formed displays are the most advanced field from the standpoint of preprinting and forming to close tolerances.

Formed plastic displays are in a class of their own—a class with which no other type of fabricated plastic, wood, metal, or paper displays can compare. For example, a display that sells for $50 when made of wood can be made faster and better by vacuum forming a plastics sheet at a cost of $5.

In the Christmas decoration field, almost every manufacturer has switched to vacuum forming. In such an industry, where product life is short and where profits must be made fast, vacuum forming fills an important need.

As production runs continue to increase and as Christmas displays grow in both demand and size, the percentage of plastics being consumed by this market is increasing. On the large side, Tico Plastics, Inc., New York, N.Y., is vacuum forming a hard vinyl Santa Claus display, 58 in. high and weighing 4 pounds.

On the small side, but in huge quantities, Borkland Mfg. Co., Marion, Ind.—a pioneer in the field credited with several patents on vacuum forming—produces a Santa figure 5 in. high by 2 in. wide, 40 up in two colors, on 24- by 36-in. sheets, at the rate of 2000 per hour. Gregstrom Corp. forms twelve 18- by 14-in. Santa faces on a 48- by 84-in. sheet of vinyl at the rate of 700 faces an hour.

Big Displays

The vacuum forming job being done on big and colorful store, counter, and window displays ranges from sensational to fantastic. The design potential inherent in formed displays has captured the

(*Continued on p.* 188)

Metal box for cake decorating set (top) is replaced by vacuum formed model

Courtesy Auburn Button Works, Inc.

Formed contour packages for hardware items are suitable for re-use after purchase as a convenient receptacle for the tools

Courtesy Fabri-Kal Corp.

Realistic coffee-pot for window display (foreground) is formed from silver-metallized sheet. Only base and handle of pot require painting

Peak Performance

New Zenith hearing aid uses transistors protected by epoxy castings; seven other plastics give excellent electrical and mechanical properties to components

THE diminutive transistor, which can perform many of the functions of the vacuum tube without its bulk and certain other limitations, is playing an ever-expanding role in the electronics and communications field. Utilizing a plastic enclosure which provides mechanical protection as well as electrical insulation for the delicate internal parts and connections, the transistor has now outgrown the laboratory stage and is finding its way into volume applications such as hearing aids, which are themselves constructed largely of plastics.

One of the newest transistor-type hearing aids to reach the market is the Royal-T, a product of Zenith Radio Corp. In this instrument, the customary sub-miniature vacuum tubes are replaced by three Raytheon transistors. The cast epoxy enclosure used for these transistors provides physical protection. The outstanding feature of the Royal-T, in addition to its excellent performance, is the fact that it will operate for a month on a 15¢ dry cell. This compares with a battery replacement cost of from $4.50 to $9.00 per month for tube-type hearing aids.

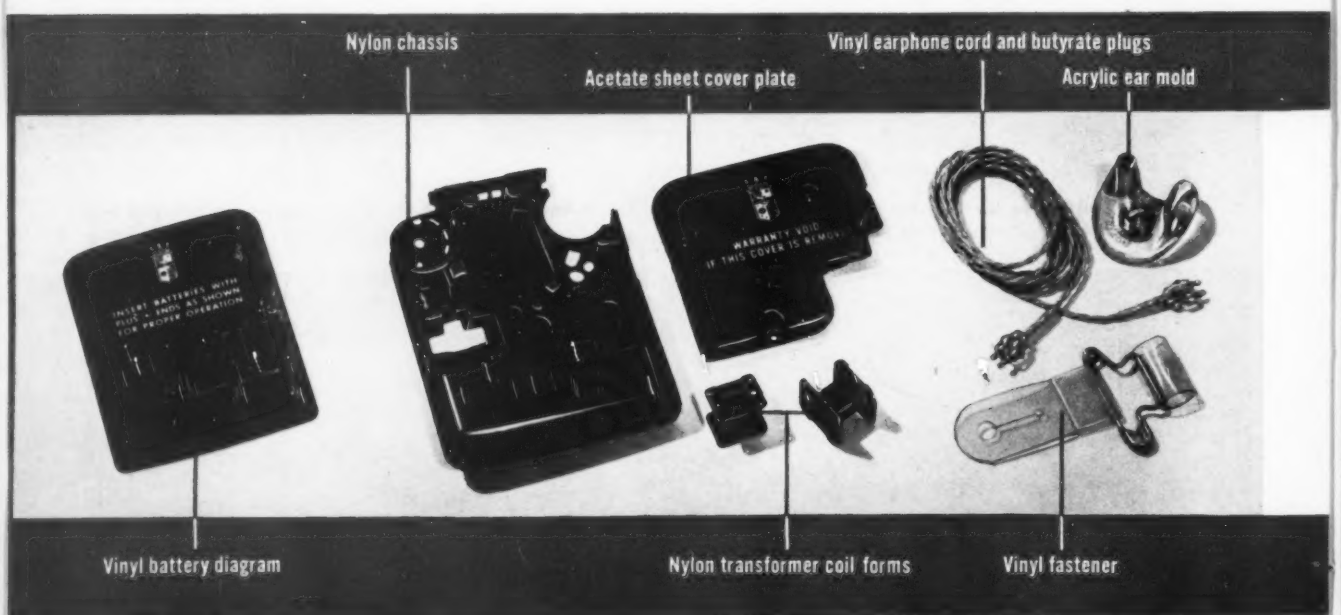
Plastics Dominate

In addition to the transistors themselves, the Royal-T hearing aid provides an excellent example of the dominant role of plastics in these instruments. Seven plastics—nylon, styrene, acrylic, vinyl, acetate, butyrate, and phenolic—are used for essential components.

Non-hearing aid users may not appreciate the rough treatment which these instruments must frequently withstand. Zenith Radio Corp. files contain numerous letters from grateful owners reporting how their hearing aids have survived repeated dropping, accidental submersion in water, and a variety of other mishaps without damage. One overenthusiastic bowler inadvertently sent his hearing aid skittering down the alley with his bowling ball, without impairing the unit.

Such performance reflects the exhaustive testing conducted by hearing aid manufacturers before authorizing volume production of a new instrument. The Royal-T, for example, was submitted to temperature and humidity tests in the laboratory, in addition to actual performance tests in the field. The laboratory tests included 1) "Bowser box" tests, in which the units were exposed 16 hr. daily to a temperature of 105° F. and 95% relative humitidy, as well as 8 hr. daily under standard room conditions, and 2) continuous exposure to 105° F. without humidity control. The primary purpose of these tests was to determine the dimensional sta-

PLASTICS PARTS IN NEW



With Plastics

bility of the instrument under elevated temperature and high humidity and the general aging properties of the unit.

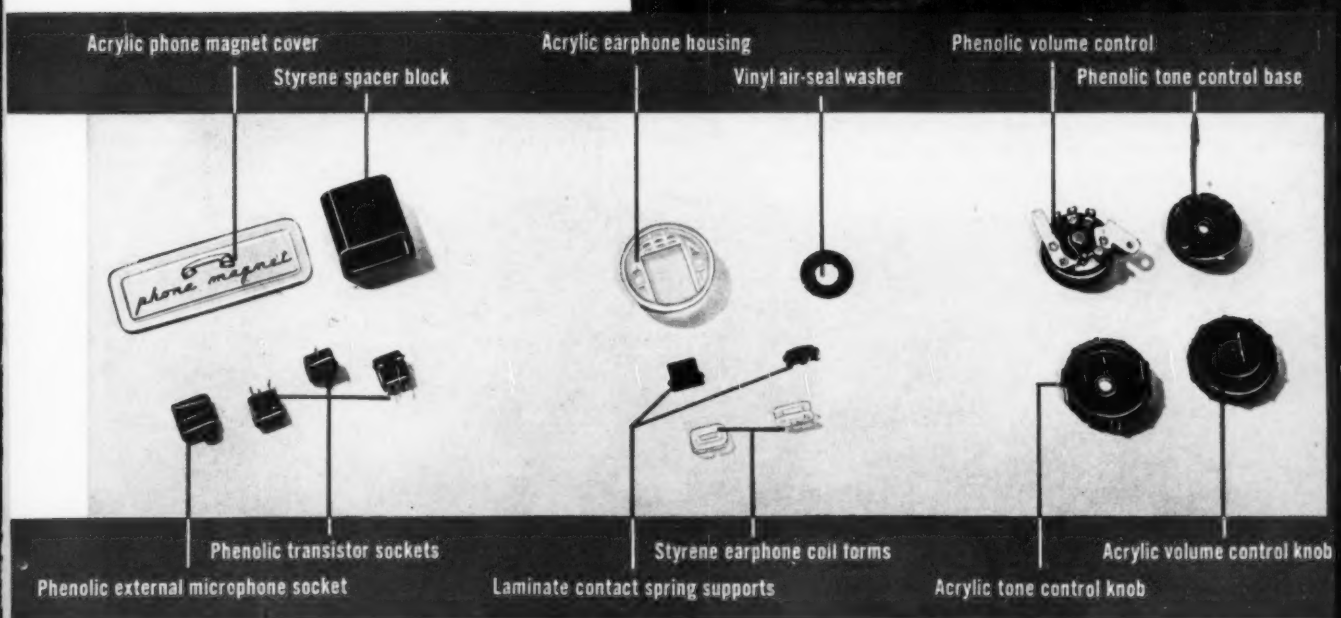
Nylon Chassis

The rugged chassis forming the main structural component of the Royal-T is injection molded of black nylon. Specification of nylon for this intricately cored part was based on its exceptional impact resistance, especially in thin sections, its light weight, and the fact that it successfully resists cosmetics with which it may frequently come in contact. Its electrical properties are excellent and moisture absorption satisfactory. The high heat resistance of the material also permits soldering operations in close proximity to the chassis without damage, while its horn-like resiliency allows the use of small drive screws in molded cores without danger of breaking out. Zenith has had no reports of chassis breakage in several

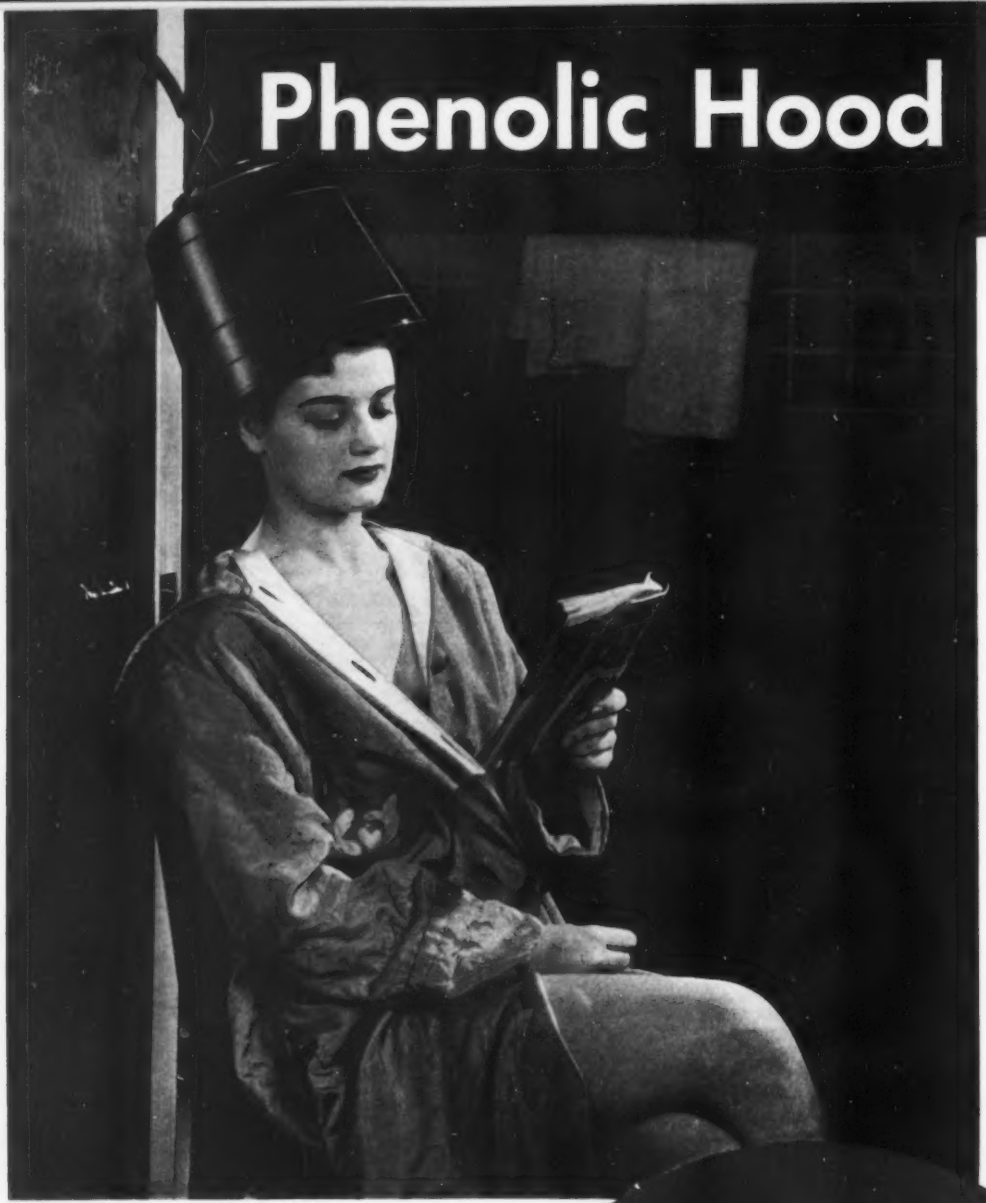
(*Continued on p.* 198)

Small, efficient hearing aid uses transistors (held next to unit) and variety of plastics for its parts
Courtesy Zenith Radio Corp.

ZENITH HEARING AID

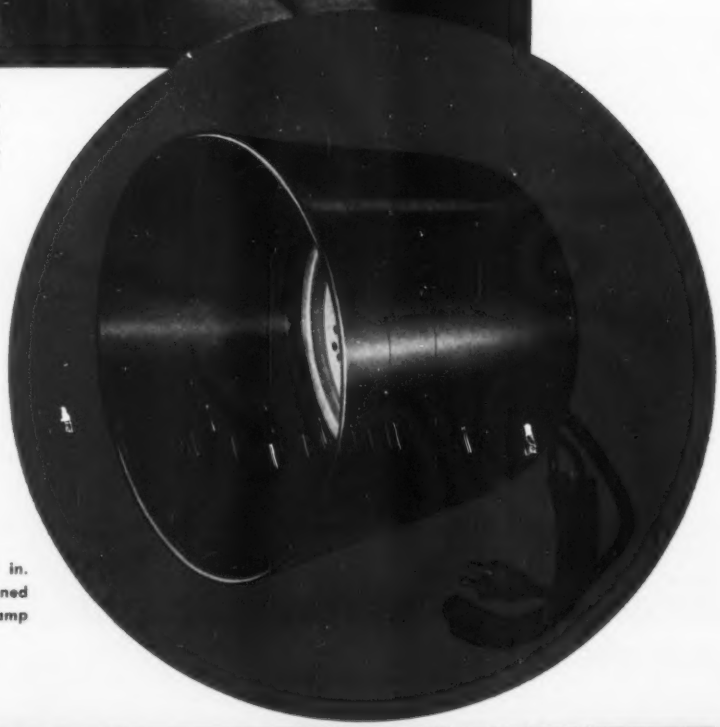


Phenolic Hood for



Photos courtesy Durez Plastics and Chemicals, Inc.

Milady can now dry her tresses in the comfort of her own home without fuss or bother, thanks largely to the use of a molded phenolic housing in this hair dryer



Lightweight, sturdy, heat-resistant phenolic hood, 9 in. deep and with a diameter of over 10 in., can be fastened to edge of door by means of a padded spring steel clamp

Hair Dryer

Thermal and electrical insulating qualities, plus durability, light weight, and integral color determined choice of molding material

HAIR drying at home need no longer be a chore, thanks to the Magic home hair dryer produced by W. F. Meyer & Sons, Inc., Chicago, Ill. This helmet-style dryer, incorporating a 350-w. heating element and powered by a silent fan which provides circulation of warm air for fast, complete drying, utilizes a molded phenolic housing that combines such advantages as integral color, light weight, electrical and thermal insulation, pleasing design, and rapid, economical assembly.

Measuring 9¼ in. deep and 10⅜ in. in diameter, the dryer is designed for convenience as well as efficient operation. A rubber padded steel tension clamp on the top of the dryer, having a hinged mounting which permits adjustment to any desired angle, clamps the unit firmly to any door at a convenient height.

Reasons for Phenolic

The selection of general-purpose phenolic material for the main component of this appliance was based on several important considerations. First and foremost, a thermosetting material was indicated because the hood must withstand elevated temperatures created by the heating element. The dryer carries the Underwriters' label.

The durability and light weight of the plastic material are advantageous in shipping as well as in use, while its sound-deadening characteristics help to insure quiet operation of the 110-v., 60-cycle motor. Insulating qualities of the molded plastic housing insure that the dryer will not become unpleasantly warm to the touch and also eliminate any possibility of electrical shocks. Thanks to the design freedom inherent in molded plastic parts, it was possible to incorporate three exterior circumferential ribs which contribute added eye appeal.

Had this unit been fabricated of metal, additional finishing operations would have been required to provide the desired surface finish and color, and chipping or rubbing off of color would have posed a continuing problem in shipping and service. The molded plastic hood, on the other hand, has an integral rich jet black color and derives its smooth finish directly from the highly polished mold, eliminating costly finishing operations. The manufacturer has found that the standard black color is well accepted.

Preforms Used

The phenolic hood, which weighs 29 oz., is compression molded on a 450-ton press in a single cavity mold. Material is preformed and electronically preheated in the interest of an efficient molding cycle and complete cure. The job consists of a straight draw with no side cores and the part has an average wall section of approximately ⅛ inch.

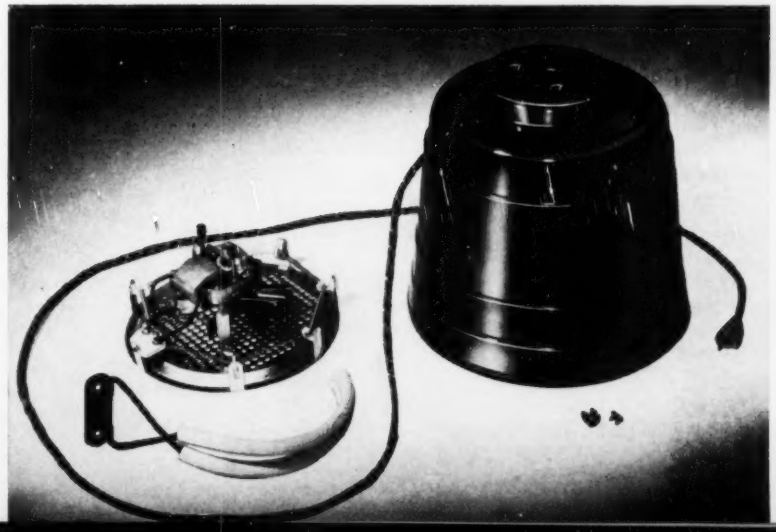
A total of 18 openings are cored in the flat top surface of the hood and one additional hole in the "shoulder" area through which the electric cord passes. The majority of the openings are designed to permit circulation of air during operation of the dryer, while the large center core locates and anchors the fan and heater assembly when it is mounted in the hood. This is accomplished by means of a metal dome over the end of the motor shaft which nests in the opening. The two remaining large cores, reinforced by heavy internal bosses, provide for attachment of the entire internal assembly to the top of the hood by means of two bolts which are secured from the outside with nuts.

The hinged support for the steel tension clamps is also held in place by the same bolts, completing a simplified assembly and eliminating the need for molded-in inserts which might have slowed the cycle or complicated the molding of the part. Easy removal of flash from the bottom rim of the hood is the only additional operation performed by the molder before shipping the part.

At the Meyer plant, the electric

(*Continued on p. 199*)

Cored openings in hood are for air circulation and fastening of internal assembly and clamp; small phenolic parts (right) interlock in assembly to form strain relief collar



Photos courtesy Rand McNally Co.

Giant world globe being inspected here is made of sections of acrylic sheet fastened to a steel frame. Symbols placed on globe surface are also made of acrylic

The World in Acrylic

ONE THOUSAND pounds of acrylic sheet and over two years of work were required to complete a giant plastic world globe for the S. C. Johnson & Son, Inc. plant in Racine, Wisconsin. This globe, proposed by Frank Lloyd Wright, is now located in a small parkway opposite the west entrance of the Johnson's Wax administration building in Racine. It is an 11-ft. sphere lighted from within, showing in different colors all of the oceans, seas, and major land masses.

This globe was made in two hemispheres with the equator as the dividing line. Each hemisphere consists of 12 acrylic sections. A framework of steel supports the outer shell. Sections of Plexiglas are attached to the framework by bronze clips which allow for expansion and contraction caused by temperature variations.

To produce this globe, the land areas were cut out from the ¼ in. thick sea-green arcylic sheet used in the hemispheres. The land areas to be used were then fabricated from ½-in. golden tan acrylic and glued into the cut out sections so that they were flush on the underside and projected ¼ in. above the surface, thereby making the coast lines appear in relief. Acrylic symbols of different shapes and colors, designating the Johnson plants and offices, were then installed in their proper locations.

CREDITS: Cartography and design by Rand McNally Co., Chicago, Ill., Acrylic sheet by Rohm and Haas Co., Engineering and construction by Steiner Plastics Co., Glen Cove, N.Y.

Globe is assembled by attaching 24 formed "orange peel" sections of acrylic sheet to supporting frame by means of bronze clips

Land masses, shaped from ½-in. tan sheet, are glued into matching cut-outs in ¼-in. sea-green acrylic so they are flush on underside

'POPCORN' PLASTIC

Molded polystyrene foam, produced from tiny hard beads when heated in a mold, has good thermal insulating and low water absorption properties

FLOATS, thermal insulation, sandwich constructions, toys, novelties, and displays are some of the products that can be made from Koppers' recently announced polystyrene foam. It is so new that a name has not even been picked for this budding new prospect in the polystyrene family.

The new material is quite different from any other polystyrene foam on the market in that it is furnished in tiny, hard polystyrene beads impregnated with a special foaming agent. One truckload of beads will make as much as 30 truckloads of tough, strong, rigid foam. The beads react under heat somewhat like the moisture within a kernel of corn. They are actually "popped" into various shapes and sizes in heated molds in a single operation. Heretofore, foamed polystyrene has been furnished only in rigid sheet or log forms that must be fabricated into whatever shape is needed for the job at hand.

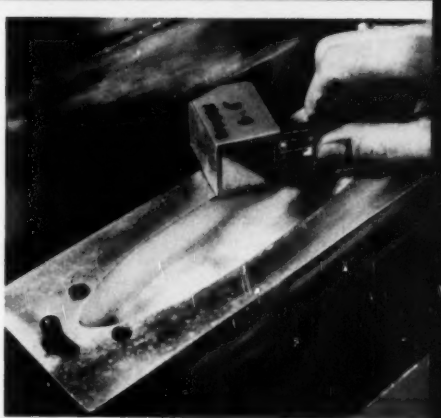
No definite machine is specified for molding the foamed material. The simple equipment needed can be built in most any machine shop. A source of steam and a frame for the mold are the basic requirements. The temperature needed for expansion of the beads is 110 to 135° C., and steam pressures for satisfactory expansion generally lie in the range of 10 to 30 p.s.i.

Beauty rides the waves on buoyant, expanded-styrene raft; toys aboard are same material

Expansion Methods

Three methods are suggested for the expansion process: 1) direct introduction of dry steam in the mold cavity, 2) steam heated molds, and 3) molds heated by hot air. Choice of method is governed by the thickness of the article to be molded. Where sections of foam 1 in. or greater in thickness are to be produced, the first method is recommended. Either of the other two methods can be used for sections that are to be less than 1 in. thick, but steam heated molds give shorter expansion cycles than are generally obtained with hot air.

Brass, bronze, aluminum, or steel are satisfactory mold materials. A simple housewife's salad mold was used at a Koppers demonstration, but brass and bronze are recommended as most desirable from the standpoint of ease of finishing, strength, dimensional stability, and parting of the molded piece. Wall thickness in molds should be at least ¼ in.; internal pressure up to 50 p.s.i. may be developed during expansion. The molds should be fabricated so that steam can enter



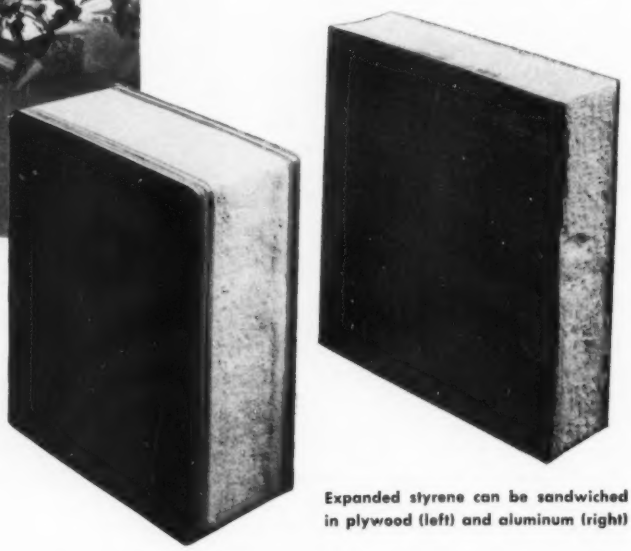
Small amount of resin in mold expands to make toy boat on raft above

Thermal insulation of slabs of expanded styrene lets ensemble clad in bathing suits perform in comfort on cakes of ice

suitable for use in the packaging, display, insulation, and various other fields.

All molded foam pieces come out of the mold with a high-density, smooth finish skin which enhances the strength properties of this lightweight material and gives it a slick, hard surface quite unlike that of any other known expanded styrene. The high-density skin also contributes to the material's toughness and resistance to fracture by impact. A man can stand on a small piece of the expanded material without crushing it, yet it can be easily sawed, planed, and shaped in a manner similar to wood. It can also be cut or fashioned with a hot resistance wire, although this method is most successful with low-density material—2 to 4 lb. per cu. foot. Higher-density material cuts much more slowly and tends to fuse together on the cut surfaces.

The maximum temperature for continuous use to which Koppers polystyrene foam should be exposed when not under load is 175° F. It burns at the rate of 4 to 5 in. per min., but an open flame is necessary for ignition and free access to air is needed for continued burning. The material will not support fungus growth and has no food value for vermin or insects. Electrical properties are undetermined as yet, but it is expected that the dielectric constant and power factor will be very low.



Expanded styrene can be sandwiched in plywood (left) and aluminum (right)

the cavity through $\frac{1}{32}$-in. holes in the mold walls.

Expansion cycles for the direct steam method may be as short as 10 sec. for small pieces and up to 3 min. for sections 12 in. thick. With molds heated by steam or hot air, the cycle is about 10 min. for the former and 20 min. for the latter to produce a 1 in. thick section. Cooling time varies from ½ min. for small articles to 10 to 15 min. for pieces 12 in. thick. Shock cooling must be avoided as it will cause immediate shrinkage.

Pre-Expanded Material

The entire molding cycle is claimed to be shorter than that employed in injection molding for pieces of comparable size.

While Koppers expandable polystyrene beads are normally charged to molds in the unexpanded state, for some applications the use of partially pre-expanded beads may be desirable. This is so when molding large pieces with thick sections, or irregular shapes, or pieces of density less than 2 lb. per cu. foot. Pre-expansion is accomplished by exposing the beads to dry heat for a sufficient time to accomplish the desired degree of expansion.

Extrusion of this expandable material is also possible and will undoubtedly be applied to products

The first area to which Koppers foam is expected to be applied in a big way is thermal insulation. It is claimed to have better insulating properties than cork, fibrous glass, or mineral wool. It also has low water absorption (less than 0.5% by volume after immersion for eight days at room temperature), low water vapor permeability (0.5 to 1.0 grains / hr. / sq. ft. / in. of thickness / in. Hg. vapor pressure difference), and low density (2 to 10 lb. per cu. foot). Girls dressed in bathing suits at the Koppers demonstration sat on cakes of ice covered with 1 in. thick sheets of molded foam and reported no more discomfort from cold than if they had been sitting in an ordinary chair.

Possible Applications

With all the above properties combined in one material, an excellent low-temperature insulation material can be expected. Furthermore, it can be molded to fit insulation areas such as the contours of refrigerator and freezer cabinets, trailer bodies, refrigerator cars, and low-temperature industrial piping. The top sheet of insulation board for a refrigerator could be molded in 3 minutes. It is possible that molding apparatus could be built so that all parts of the insulation for a butcher's refrigerated room could be produced in record time and then put in place with little time spent for fitting or fabricating.

An interesting angle to this insulation process is that once the beads are expanded, the expanded sheet may then be compressed to form a higher-density, lightweight insulation board that could be used for truck lining and similar applications. For example, such material could be the liner or part of the sandwich for large-size boxes used by frozen food packers when shipping their packaged goods to retail outlets. Furthermore, the foam won't "wilt" when it gets wet. It could easily become another of the numerous plastics sheet materials that have been coming to market in ever-increasing variety for several years.

Strength Properties of Koppers Polystyrene Foam

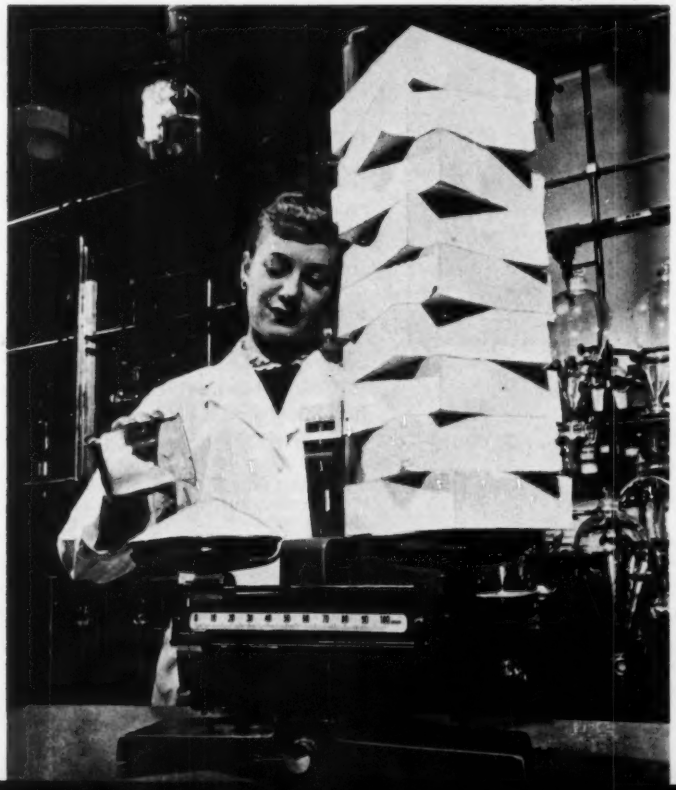
The mechanical properties of Koppers polystyrene foam vary somewhat with temperature since it is made of polystyrene, which is thermoplastic. Values below are for foams at room temperature and will decrease slightly as the temperature approaches the heat distortion point.

Property	*Density, lb./cu. ft.* 2	3	4	6	8	10
Tensile strength 73° F. (p.s.i.) ASTM D651-48*	30 to 50	55 to 75	65 to 85	90 to 110	110 to 120	120 to 130
Compressive strength 73° F. (p.s.i.) 5% off-set ASTM C165-45*	15 to 20	25 to 35	40 to 50	60 to 70	70 to 80	90 to 100
Flexural strength 73° F. (p.s.i.) ASTM D790-49T*	Flexible	60 to 90	90 to 120	130 to 160	200 to 230	280 to 310
Impact strength 73° F. (in.-lb./in.) Unnotched (1 in. wide specimen) ASTM D256-47T*	2.0 to 2.5	2.3 to 2.8	2.5 to 3.0	3.0 to 3.5	4.3 to 4.8	5.0 to 5.5

* Test specimen size varied as necessary.

Large stack of blocks of expanded polystyrene on right side of scale weighs exactly the same as small quantity of beads of expandable polystyrene on left side of scale

Photos courtesy Koppers Co., Inc.



Cost Factors

The cost of Koppers polystyrene foam material for insulation is quite reasonable in comparison to other foams. The "beads" or molding material sell for 60¢ a pound. The only other styrene foam material sells for around 55¢ a lb. in sheet form and weighs around 2 lb. per cu. ft., and there is generally considerable loss of material in the fabricating process.

The estimated cost of resin per board foot of Koppers foam runs from 10 to 50¢, depending upon density. Expanded or foamed materials are made from many kinds of plastics and have a wide variation in price. According to Koppers ana-

(*Continued on p. 200*)

All-plastics detergent dispensing brush

Suds, Scrubs, Scrapes

WASHING dishes—traditionally not a pleasant chore—is made easier by the introduction of an all-plastics brush that cuts dishwashing time in half.

In designing the unit so that it can do double-duty either as a liquid detergent dispenser or as a scrubbing brush, the manufacturer, I. J. Moritt Products Co., Inc., New York, N. Y., used styrene, polyethylene, and nylon to advantage. The entire brush housing, including handle, stem, and head, is molded of high-impact styrene; bristles in the scrubbing brush are nylon; and the button which is pressed to dispense the detergent is molded of polyethylene.

The smartly styled brush is available in a green, red, or yellow housing. The polyethylene button, the styrene cap on the end of the handle, and the replaceable scrubbing brush unit that easily slips on over the top of the housing, are all supplied in contrasting black. The complete unit is only 10 in. long and, when empty, weighs about 4 ounces.

Streamlined and Versatile

In addition to its attractiveness, the brush is a versatile tool that is equally suitable for sudsing, scrubbing, or scraping dirty dishes. Because the plastics are unaffected by any commercial cleaning detergent, an ample supply can be stored in a reservoir in the hollow styrene handle.

The liquid is dispensed by pressing the polyethylene button in the handle. This action forces a controlled amount of detergent up an extruded styrene tube in the stem of the brush and shoots it out through a molded-in opening in the head of the housing right onto the dish which is being scrubbed. For the more difficult cleaning jobs, such as sticky baking dishes, a rugged styrene scraper molded-into the rear half of the head section can be used effectively.

The polyethylene button fits into a cylinder molded-into the handle. Coupled with a steel ball and a steel spring that are inserted into the cylinder in an earlier assembly operation, this button and cylinder function as a miniature piston pump. The liquid detergent enters the cylinder through a small molded-in hole and is forced by the movement of the button—which operates as the piston—into the styrene tube connected to the other side of the cylinder.

No Leakage

To eliminate any possibility of leakage, the polyethylene button is molded to close tolerances to fit snugly into the opening in the handle. The wide circular base of the button, which is snapped under the bevelled edges of this opening, extends out to the walls of the cylinder and serves as a "piston ring." A molded styrene bushing is then fitted over the top half of the button and cemented to the handle.

A small molded-in stub at the bottom of the head of the brush is connected to the other end of the styrene tube. To complete the assembly, this head section is cemented to the hollow stem which is in turn cemented to the handle.

Because of its durability and many practical features, the brush can also be used for such other household chores as shampooing rugs and upholstery or cleaning windows.

Brush dispenses liquid detergent as it scrubs (inset). Housing, including (left to right) head, stem, handle, and cap, is styrene; bristles are nylon; button is polyethylene

CREDITS: The Jet Brush Dishwasher's styrene housing and polyethylene button are molded for I. J. Moritt Products Co., Inc., by Ideal Plastics Corp., Hollis, N. Y. High-impact styrene is supplied by The Dow Chemical Co.; polyethylene by E. I. du Pont de Nemours & Co., Inc. Styrene tube is extruded by Anchor Plastics Co., Inc., Long Island City, N. Y.

Housings for these IBM Proof Machines, here being tested for accuracy before shipment to banks, are made of structural laminations of sheet steel and polyvinyl chloride sheet
Courtesy International Business Machines Corp.

Close-up of an IBM Proof Machine housing (below) shows that vinyl-steel laminates can be formed into sharp bends as well as gentle curves
Courtesy Hood Rubber Co.

VINYL-STEEL LAMINATES

New composite material forms readily in production of business machine housing

FEW pieces of industrial or commercial machinery have to take the daily beating regularly endured by IBM Proof Machines. These electro-mechanical devices in thousands of banks solve the problems inherent in endorsing, sorting, proving, and listing bank checks. Since 20 million checks are written every day in the United States, covering 90% of all exchange of money, these machines are very busy, and "down time" must be kept to a minimum to assure efficient operation.

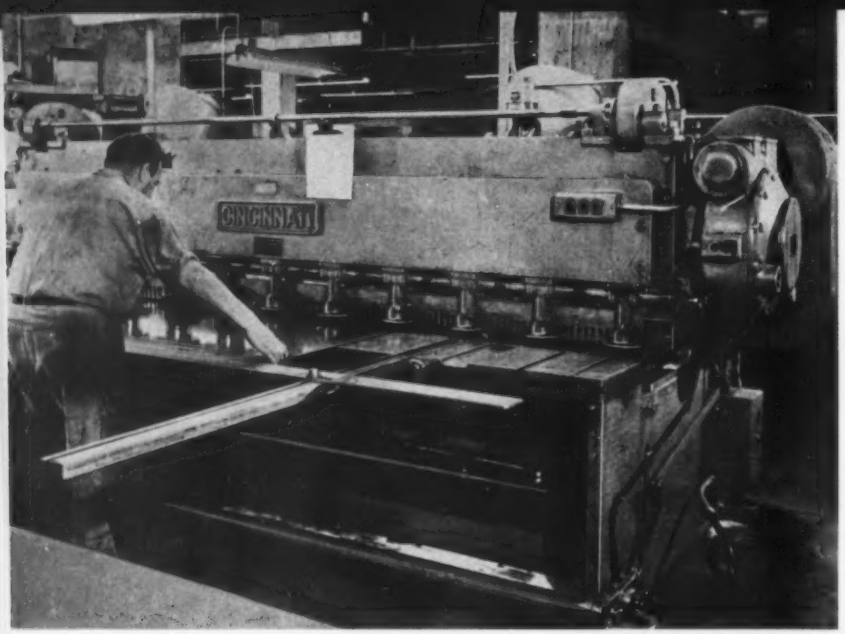
But bank equipment must also be clean and handsome at all times. So the streamlined housing of the Proof Machine had to be made of a material that could "take it," because refinishing of a conventional painted housing could mean expensive "down time."

The material used in the housings of these machines is a structural lamination of sheet steel and polyvinyl chloride sheet made from Geon resin supplied by B. F. Goodrich Chemical Co. The lamination was developed by Hood Rubber Co., Div., The B. F. Goodrich Co., and prior to 1946 was first used for fabricating railroad car arm rests, parts for aircraft interiors, and was later tested for use by IBM. Today, this laminate houses almost all the Proof Machines made by International Business Machines Corp.

Several fabricators worked and cooperated on the IBM contract in developing handling and forming techniques for this vinyl-metal laminate. One of these is the Karp Metal Products Co., Div. H. & B. American Machine Co., Brooklyn, N. Y.

On 18-Gage Steel

Both hot-rolled and cold-rolled steel sheets in various gages as well as aluminum sheet have been used by Hood Rubber Co., Div., The B. F. Goodrich Co., for this lamination. On the IBM job, 18-gage cold-rolled sheet with a thickness of 0.047 in. is used, and forms well in production fabricating. Vinyl sheets of from 5- to 20-mils thickness have been used successfully. The formulation of Geon 101 EP resin in compound calls for polymeric plasticizers,



Sheets of vinyl-steel laminate are trimmed to correct dimensions by shearing machine before further fabrication

good light and heat stabilizers, only enough pigment and fillers for opacity requirements. Hood Rubber's standard for the vinyl sheet before lamination to metal demands high tensile strength with suitable elongation for subsequent fabricating operations.

The adhesive used by the makers of the laminate is their secret; so is the method of application. There are different methods of laminating the metal to the vinyl, including the use of hydraulic presses and roller method. Embossing may or may not be accomplished at the same time. A tolerance of ± 0.005 in. is allowed on the total vinyl-steel laminate.

The reasons why IBM uses this lamination in place of enameled steel, even at an extra cost of up to $70 per machine, become obvious when its various characteristics and properties are studied.

Important Properties

First, abrasion resistance is spectacular. On a Tabor abrader, using a CS-17 wheel and a 1000-g. load, only 0.36 g. were lost in 4000 revolutions. No machine housing would ever have to take that punishment. Second, the vinyl surface is readily cleanable. IBM has developed a wax emulsion for the purpose which is remarkably effective even on shallow cigarette burns; for repair of deep cuts or burns a paste mixture is used, same color as the vinyl sheet. Third, the adhesive bond is good, averaging in present production 38 lb./in. of width. Tests have shown that after exposure to 150° F. for ten days, the adhesion is unchanged. Fourth, the laminate can stand changes in temperature over a wide climatic range. Fifth, of course, is the combination of pleasant feel, satiny appearance, and unlimited color possibilities.

Given a high-quality vinyl-steel laminate to start with, there still remains the problem of producing a satisfactory fabricated part from it. Since it is more than half steel, it must be formed, drawn, sheared, and punched on tools designed for steel; but, being surfaced with vinyl

Dutch bend in edges of reel door for IBM Proof Machine is made on 285-ton press (safety guard removed), holds two vinyl-steel laminate parts together

Sheet of polyvinyl chloride laminated to steel sheet is shown being blanked on a 285-ton double-crank punch press (safety guard removed for better view of work)

plastic, it must not be punished in fabrication. Karp Metal Products Co. has worked out the "gentle touch" in its shops and has trained workmen in the proper handling of the laminate.

For any deep drawing—and it has been cold drawn up to 26 in.—the laminate should be maintained at room temperature at least overnight before drawing is attempted. Regular steel forming dies may be used, but clearance at critical points must be worked out; sometimes it is advisable to use clamp rings and reduced pressures. Where a bend of high degree on a component edge is required, a "dutch" bend is used, with the laminate notched so the steel will not cut into the vinyl. For this and other types of bends, all corner edges are coated with vinyl cement to cover exposed cut edges.

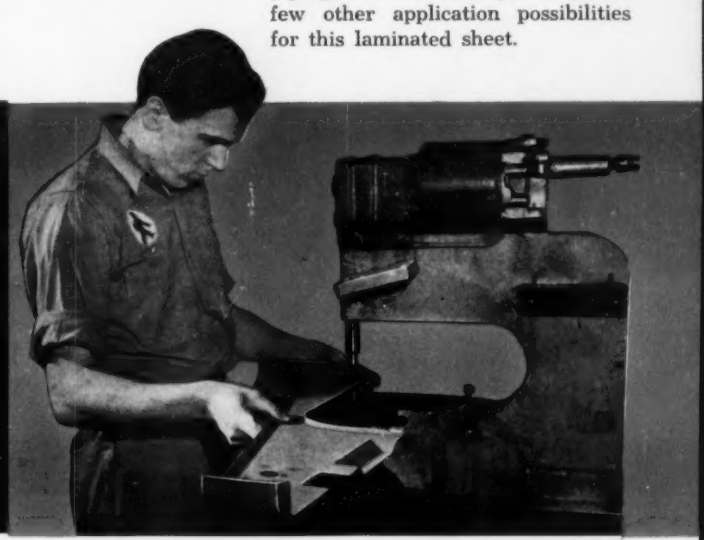
All stamping work and other operations are done with the vinyl side down, not infrequently protected by thin cardboard. All fabricated parts are back-painted before assembling, each piece, after cleaning, having its edge hand-painted, then the metal side spray-painted. Riveting of fabricated parts presents no problem.

Using these technique refinements, it is possible to shape the laminate to 180° bends, to draw, stamp and punch it.

Other Uses

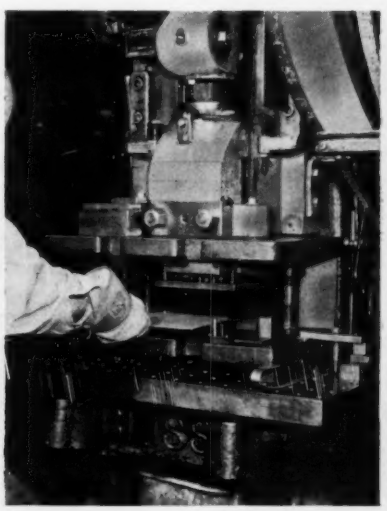
Presently fairly high in cost, this vinyl-metal structural sheet may be expected to invade more markets when production economies now under study come to quantity application. More business machines will be housed in it, of course. Vending machines, luggage, automobile interior parts, building siding, bridge table tops, wall paneling, containers for chemicals, chemical ducts and piping, and counter tops are just a few other application possibilities for this laminated sheet.

Deep-drawn knee well for lower front cover of IBM machine is removed from press. Care is taken not to score or mar the vinyl



Riveting of fabricated vinyl-steel laminated items can be accomplished without difficulty. Above: assembly clips are riveted to a finished fabricated piece

First step in making a "Z" bend: operator uses press brake to make 90° bend in side panel



Corner of a piece is notched on punch press for corner bends to be made later

Photos courtesy Karp Metal Products Co.

Metal side of fabricated vinyl-steel laminate is spray painted for rust protection

PLASTICS

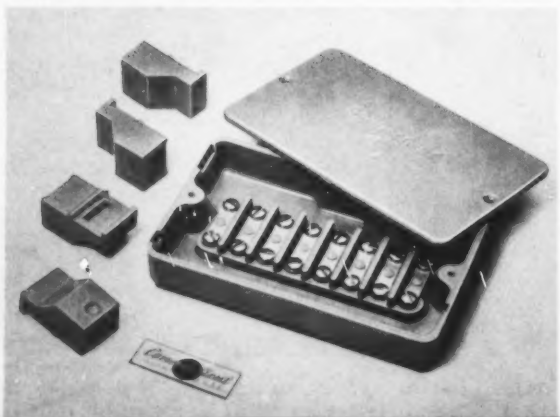
Portable Pocket-Size Slide Viewer

Folding slide viewer molded of cellulose acetate butyrate and styrene is small enough to be easily carried in a vest, shirt, or jacket pocket. The viewer will accommodate both 2 by 2-in. cardboard mounts and 2 by 2-in. glass slides. It measures $2\frac{1}{32}$ in. thick, $2\frac{7}{8}$ in. long, and $2\frac{1}{4}$ in. wide when folded.

A molded-in ground and polished optical lens provides a magnification of approximately 4 times. Complete diffusion of transmitted light is attained by a grained styrene backing screen.

The unit consists of four injection molded parts, three being made of cellulose acetate butyrate and one of styrene. All butyrate parts are molded on a 6-oz. injection machine in a four-cavity mold. The styrene part is molded in a six-cavity mold. Metal rivets and bars are used to hold the viewer together and provide pivot points.

CREDITS: Manufactured by Eastman Kodak Co., Camera Works, Rochester, N. Y. Butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn. Styrene supplied by Koppers Co., Inc., Pittsburgh, Pa.



Five-Party Intercom

Compact interoffice telephone with parts molded of cellulose acetate requires desk space of only 4 by 6 inches. Five individual private telephone lines can be linked together by means of four push-buttons. Incorporation of a magnetic switch, which operates through the housing, eliminates contact buttons on top of base and makes possible side mounting of instrument when desired. Power is provided by a 6-v. transformer which plugs into any standard 110-v. outlet.

Assembly includes nine injection molded parts: three-piece handset, base, nameplate, and four push-buttons. Two-piece molded cellulose acetate connector boxes serve as wiring junctions for the five instruments.

The escutcheon on the front of the telephone is printed cellulose acetate. Transparent acetate tips are provided to protect the cardboard name inserts on the push-buttons of the instrument.

CREDITS: Manufactured by Connecticut Telephone & Electric Corp., Meriden, Conn. Base is molded by Watertown Mfg. Co., Watertown, Conn. and handset molded by Cowan & Boyden Corp., Providence, R. I. Cellulose acetate supplied by Hercules Powder Co., Wilmington, Del.

PRODUCTS

Boilable Polyethylene Baby Bottle

A polyethylene baby bottle, designated Perma-Nurser, is claimed to resist deterioration even after 100 hours in boiling water. In addition, it is stated that the insulating properties of the polyethylene bottle will keep a formula warm five times as long as its glass counterpart. The most outstanding advantage is its unbreakability which eliminates the expense of bottle replacement and, perhaps more important, inconvenience at crucial baby feeding times.

The nursing bottle has a capacity of 8 oz. and a raised graduated scale on the side. The flexibility of the material provides an easy grasp and natural feel to the baby.

The bottles are manufactured by the blow molding process. The molded-in threads in the top will fit any conventional cap and nipple. Each bottle has an individual sleeve with printed instructions.

CREDITS: Supplied by W. Braun Co., Inc., 715 Fifth Ave., New York, N. Y., for Perma-Nurser Co., New York, N. Y. Polyethylene supplied by Bakelite Co., New York, N. Y., and E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

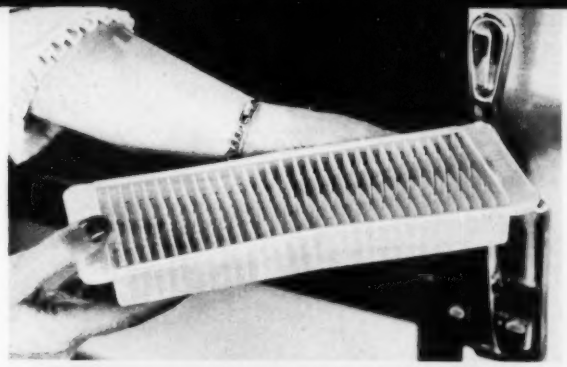
Ice Chipper Tray

Crushed ice for salads, desserts, and other kitchen and household uses can be made quickly and easily using a polyethylene flexible ice chipper tray. The tray is divided into 60 compartments which, when filled with water and frozen, produce slim ice wafers. The frozen wafers are crushed by the grinding action of the separators when the tray is twisted at both ends. The crushed ice is then tapped out onto waxed paper or into a bag or bowl.

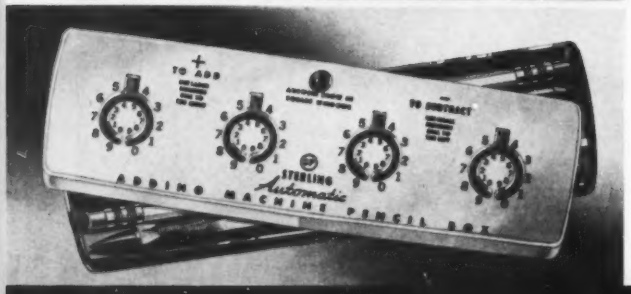
The chipper tray has extended lips on the ends to provide a good grip for both hands during the twisting and grinding operation. The chipper tray, the same size as a regulation ice cube tray, can be stored in the freezer or ice cube section of the refrigerator.

The ice chipper tray is molded of polyethylene in an injection molding machine. It is available in frost white and comes packaged in cellophane, with descriptive literature enclosed.

CREDITS: Molded and packaged by the Gits Molding Corp., 4600 W. Huron St., Chicago, Ill. Polyethylene supplied by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.



PLASTICS



Adding Machine Pencil Box

A combination adding machine and pencil box, molded of styrene and nylon, is ideal for school, home, and office. Addition and subtraction can be accomplished by rotating the four numbered dials, clockwise for addition and counter-clockwise for subtraction.

Precision gears for the adding machine mechanism are injection molded of nylon and accurately fitted into the top housing. The adding machine housing and pencil box case are injection molded of styrene. Top and bottom components are joined by means of a metal rivet. The top pivots horizontally to permit easy access to the enclosed supplies.

Included with the adding machine pencil box are a ball-point pen, three lead pencils, two colored pencils, numeral selector, and directions folder. The unit is approximately 7⅞ by 2⅜ by ¾ in. and is available with red base and ivory top.

CREDITS: Manufactured by Sterling Plastics Co., 1140 Commerce Ave., Union, N. J. Styrene supplied by Catalin Corp. of America, New York. N. Y. Nylon by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Spring-Operated Styrene Tube Cap

Styrene tube cap called Stayzon eliminates the use of a conventional cap on collapsible tubes for home use. The unit is available in three sizes to fit any of the three standard sizes of dental paste, shaving cream, cosmetic, or medication tubes. The styrene cap need never be removed until the tube is empty.

The tube cap is mounted to the tube by means of internal threads and consists of two sections—the threaded housing and the closure element. These parts are hinged together and are snapped open or closed by a strong metal tension spring. Cam action of the hinged element in combination with the metal spring will hold the cap in either position until pressure on the thumb tab moves it to the other position.

Both parts are injection molded of styrene on a 12-oz. injection molding machine in a precision built multicavity mold.

CREDITS: Molded by Jamison Plastic Corp., 71 E. Sunrise Highway, Freeport, L. I., N. Y., for Specialty Devices, Inc., 229 Fourth Ave., New York 3, N. Y. Styrene supplied by Catalin Corp. of America, New York, N. Y.

PRODUCTS

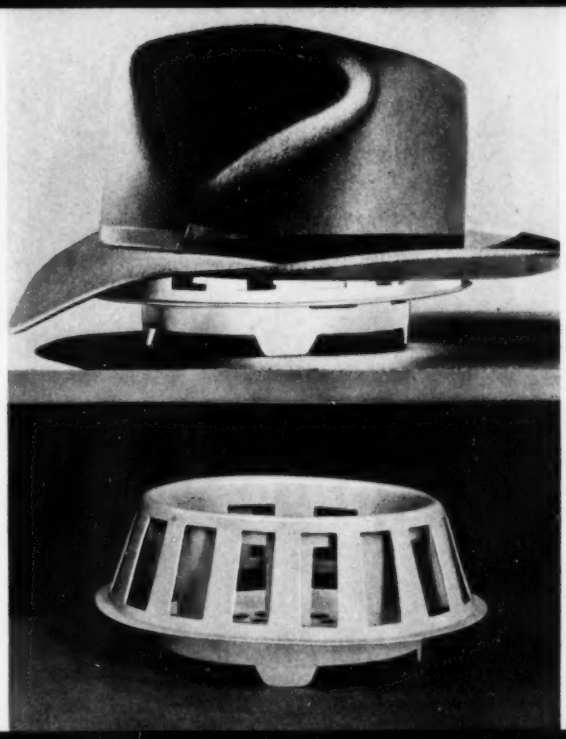
Styrene Hat Holder

Called the Keepshape Hat Rest, a hat holder molded of medium-impact styrene, provides clean, orderly storage for either men's or women's headgear. Slotted vents in the side of the hat rest permit circulation of air; the oval inner section forms a convenient storage place for a brush, pair of gloves, or other small items. The tapered shape of the holder allows it to accommodate hats of all sizes. Hats placed on the hat rest never touch a flat surface and consequently do not lose their shape prematurely.

The hat holder is molded of styrene on a 16-oz. injection molding machine, using a two-cavity mold with center gating to each cavity. No side pulls are required to produce the intricate coring of the molded piece.

Although basically a consumer item, hat stores have also found the holder ideal for window and point-of-sale display purposes.

CREDITS: Molded by Keolyn Plastics, Inc., 2731 N. Pulaski Ave., Chicago, Ill., for Keepshape Hat Rest, 141 W. Jackson Blvd., Chicago, Ill. Styrene supplied by Monsanto Chemical Co., Springfield, Mass.



Dripless Bottle Insert

A carefully engineered collar or casing of polyethylene inserted into the neck of a bottle is claimed to render it completely dripless without changing the outward shape of the bottle.

The collar depends for its effectiveness on the principle of surface tension. A very thin lip or edge which extends beyond the flange of the insert cuts off the flow of liquid after pouring and actually causes the last drops to fall back into the bottle. The polyethylene collar offers material cleanliness and durability plus an extremely smooth surface which eliminates friction and permits easy removal and resealing of the bottle closure or cap. The collar itself can also be easily removed.

The insert is molded on an injection molding machine in a 30-cavity mold. The molded collar is inserted into the bottle neck by automatic machinery during the bottling operation.

CREDITS: Molded by American Molding Co., San Francisco, Calif. and Lumelite Corp., Pawling, N. Y. for the Roma Wine Co., 582 Market St., San Francisco, Calif. Polyethylene supplied by Bakelite Co., New York, N. Y.

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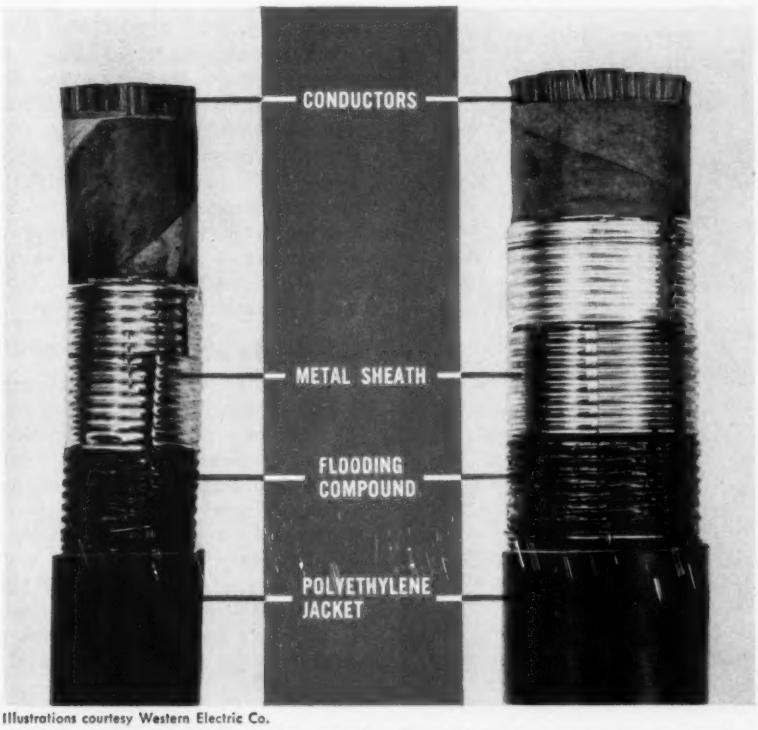
Thickness Gaging and Control

Electrical capacitance between inner metallic element and outer surface probes indicates wall thickness of an extruded polyethylene cable sheath

by W. T. Eppler†

Producers of extruded plastics pipe and tubing have long felt the need for a non-destructive method of continuously measuring the wall thickness of their product as it emerges from the extruder. This need was pointed out specifically in the "Plastics Futures" (March 1952) issue of *Modern Plastics*. Now the basis of a method for making such measurements appears to be available as the result of a procedure developed for measuring the wall thickness of polyethylene cable sheath. That procedure, described in the accompanying article, makes possible die and extruder adjustments during the extrusion operation. The equipment, with suitable modifications, might be adapted to measuring the wall section of extruded pipe and tubing as it comes from the die. In such work, the mandrel of the pipe or tube die must project beyond the face of the die but it is not necessary that any part of the measuring equipment make contact with the outer surface of the still soft extrusion.—*Engineering Editor*



Illustrations courtesy Western Electric Co.

Fig. 1—Construction details of the two cables for which gaging method was developed

AN OUTER sheath of polyethylene is applied by conventional extrusion techniques to certain special telephone cables known as Alpeth and Stalpeth as made by the Western Electric Co. For reasons of quality and economy, it is desirable to make this outer sheath of uniform thickness throughout. It is obvious that, if the sheath is eccentric to the core rather than concentric, it must have a greater average thickness if the thickness of the thin side is not to fall below a minimum which has been specified.

Until the development of the technique to be described, it was not possible to obtain a high degree of thickness control during extrusion, primarily because thickness measurements could not be obtained until the sheath had been extruded on the cable, and then only by cutting the sheath and making the measurements by mechanical means. Under such conditions, it is necessary to extrude a sheath with an average thickness greater than that specified in order to insure that minimum thickness will, in no case, be under that specified. Such a procedure is uneconomical. But by applying a gaging and control measurement system developed by Mr. B. M. Wojciechowski of the Western Electric Co.[1], based on "grounded direct" capacitance, it is possible to reduce considerably the amount of polyethylene necessary to meet given specifications.

The construction of the two cables for which the gaging method was

* Reg. U. S. Pat. Off.
† Engineer, Cable Sheath Extrusion Development, Western Electric Co., Kearney, N. J.
[1] "Continuous Incremental Thickness Measurements of Non-Conductive Cable Sheath," by B. M. Wojciechowski, *Bell System Technical Journal*, March, 1953.

developed is shown in Fig. 1. The design of a typical core tube and die for applying the polyethylene outer sheathing is shown in Fig. 2. However, because of an unbalanced flow of plastic material in a crosshead extruder, a concentric set-up of these extrusion tools around the cable core will not produce a concentric extruded sheath. The material makes a 90° turn from the extruder cylinder into the die head and, to reach the far side of the die, must flow around the core tube. The flow resistance also varies with changes in the temperature of the plastic and in the extruder screw speed.

The core tube is fixed in position in the extruder head. The die is located around the core tube and can be moved in any direction eccentric to it.

Figure 3 shows a core tube and die mounted in the extruder head as well as the four die adjusting screws by which movement of the die in relation to the fixed core tube is accomplished. To produce a sheath with satisfactory average thickness, the die must be located at some one eccentric position in relation to the core tube to compensate for the differences in flow resistances in the head.

To set the die for concentric sheath and to adjust for specified thickness, it was formerly necessary to take a sample from the lead or finish ends of the sheathed cable as shown in Fig. 4. These end samples only approximate sheath conditions because they are but short pieces representing cables which may be up to thousands of feet in length.

Sheath eccentricity is expressed as a percentage of the difference between the thickness, in mils, of the thickest and the thinnest sides of a cross section, in relation to the specified wall thickness. Control from end sampling resulted in most cables having eccentricities of 30 to 60 percent. Also, it was difficult to keep the average thickness to ±0.010 in. of the specified average thickness.

The need for better gaging than can be obtained with end sampling led to an investigation of a method of determining the wall thickness in terms of the electrical capacitance formed by the metal undersheath and a probe or probes sliding on the outer surface of the sheath. A test set, shown in Figs. 5 and 5A, responds to changes in "direct grounded" capacitance which, in turn, is calibrated into thousandths of an inch of sheath thickness. The electronic system has already been described.[2] With such a set-up it is practical to control average thicknesses of polyethylene outer sheaths within ±0.005 of an inch.

Formerly, the safe practice was to use an excess of approximately 10% of material over the specified average in order to keep the thin side of eccentric sheath within the minimum spot limit. Control from test set measurements eliminated the necessity of using this excess because sheath of improved concentricity maintained close to the specified average thickness does not vary below the specified minimum spot thickness. With such control, the quality of the sheath is improved because it is of a consistently high dimensional uniformity not previously obtainable. Also, concentric sheath has better flexing characteristics since the flexing stresses are concentrated in the thin side of eccentric sheath.

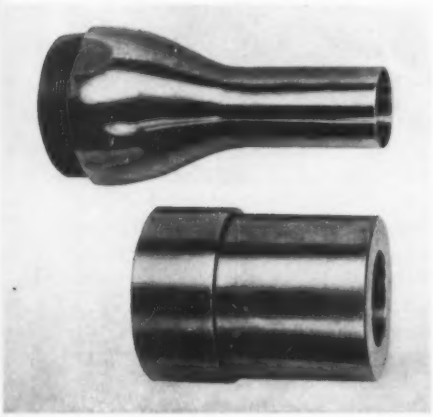


Fig. 2—Typical core tube (top) and die

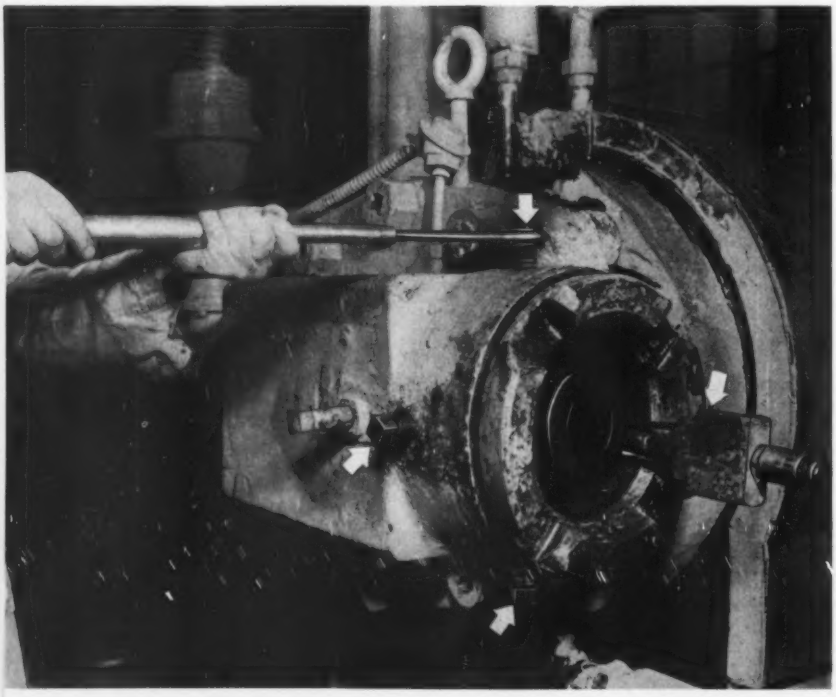


Fig. 3—Core tube and die on extruder; arrows point to locations of die adjusting screws

Calibration of Test Set

Calibration of capacitance into thickness was difficult because the capacitance is not a simple function of polyethylene thickness. It depends also on the curvature of the sheath surface, the size and shape of the probe, the amount of flooding of rubber-asphaltic compound over the corrugated undersheath, and the height and shape of the corrugated metal. For a given probe, it depends chiefly on the thickness, the flood-

[2] "Continuous Incremental Thickness Measurements of Non-Conductive Cable Sheath," by B. M. Wojciechowski, *Bell System Technical Journal*, March, 1953.

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One of the Stokes 15-ton Model 800 fully automatic molding presses at the Wayne, N. J. plant of Mack Molding Company, Inc. The 800 presses handle all thermosetting plastics, including alkyds without press modification. Cycles are fast, mold cost low.

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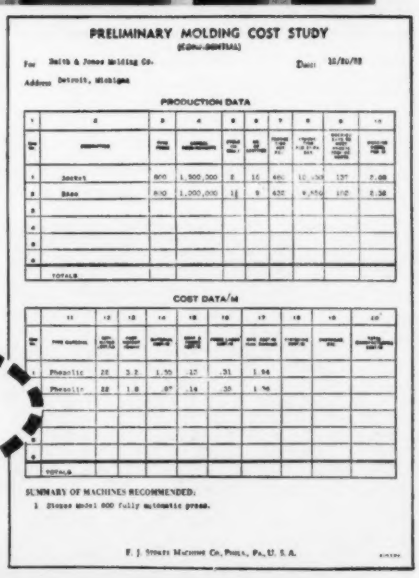

PRELIMINARY MOLDING COST STUDY

(CONFIDENTIAL)

For Smith & Jones Molding Co. Date 10/20/53

Address Detroit, Michigan

PRODUCTION DATA

No.	Description	Press Tons	Annual Requirements	Cycle per Min.	No. Cavities	Weight per Piece Oz.	Total Weight per Year Lbs.	Material Cost per Lb.	Material Cost per M
1	Socket	800	1,500,000	2	16	4½	12,150	137	7.68
2	Base	800	1,200,000	1½	8	4½	9,450	137	8.38
3									
4									
5									
6									
	TOTALS								

COST DATA/M

No.	Type Material	Mat. Cost per Lb.	Cost per Piece	Scrap Loss %	Scrap Loss Cost	Cost per M Pieces	Labor Cost	Overhead	Total Manufacturing Cost
1	Phenolic	.28	3.2	1.50	.12	.31	1.64		
2	Phenolic	.28	1.8	.8*	.16	.35	1.76		
3									
4									
5									
6									
	TOTALS								

SUMMARY OF MACHINES RECOMMENDED:

1 Stokes model 800 fully automatic press.

F. J. Stokes Machine Co., Phila., Pa., U. S. A.

Typical Stokes report on molding cost study of parts to be made by fully automatic molding.

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ing, and the sheath curvature. The flooding may vary from a thin film to an excess that overfills the corrugations. The surface curvature is not uniform because the soldering of the metal overlap of Stalpeth cable generally produces a flattened sector and the capstan at the soldering operation results in a elliptical shape. Changes in the surface curvature and in the amount of flooding can be compensating or cumulative in varying the degree of capacitance.

To determine whether a correlation between jacket thickness and capacitance existed, extensive spot checks were made for three sizes of cable. Marked points on the cable were measured for capacitance and then with a micrometer. A slight error can exist because the micrometer measurement is only one spot in the center of an area which is effective to capacitance. This condition is shown by Fig. 6. Also, it is difficult to accurately determine the surface curvature associated with the capacitance measurement.

Therefore, investigation was also made of flat samples of polyethylene placed upon a flat metal plate. Such samples eliminated the variables introduced by the cable surface curvature, the corrugated metal undersheath, and the flooding material. Plotting capacitance against thickness for the flat samples showed the great majority of points to be located within ± 0.003 in. of the curve.

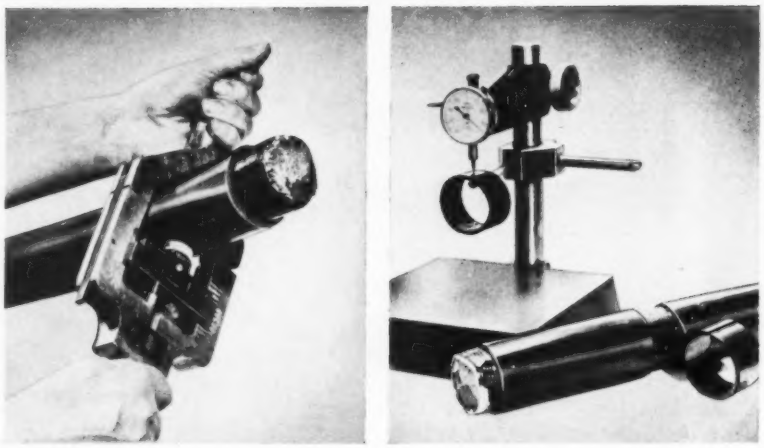


Fig. 4—In old gaging method, strip is removed from cable (left), then micrometer-measured

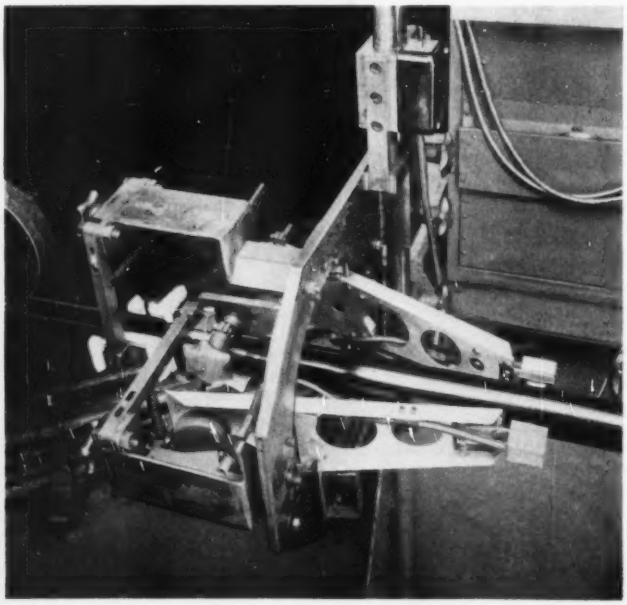
Test Results

Calibration curves for the three cable sizes and the curve for flat samples drawn to the same capacitance *vs.* thickness scale have similar form, but are displaced one from the other.

The curve for flat samples and the curve for 2.38-in. diameter cable plotted to the same scales is shown in Figure 7. The two curves are sufficiently alike so that by multiplying the flat sample curve thickness values by a constant (K_1) obtained from the ratio of the cable sheath thickness to the flat sample thickness at zero recorder scale, the amount of curvature of the resultant curve and the measured sheath curve are essentially the same and they have the same thickness and capacitance values at zero recorder reading. A multiplier (K_2) can then be added to adjust the slope of the percentage curve to make it practically coincide with the sheath thickness curve. Actually, there is

Fig. 5—Capacitance test set and unit for tracking probes on cable surface, developed to measure wall thickness of sheath

Fig. 5A—Close-up of probing unit shown left. Differences in wall thickness are detected by probes as changes in "direct-grounded" capacitances



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for Further Information

on FLEXOL plasticizer DOP, write to the district office nearest you for a copy of "FLEXOL Plasticizers" (F-5882). There are 21 offices located in principal cities. In Canada: Carbide Chemicals Sales Company, Division of Union Carbide Canada Limited, Toronto.

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Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

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Vinyl resin floor tile, plasticized with FLEXOL *DOP stands up under daily use in playrooms, libraries, kitchens, and retail stores.*

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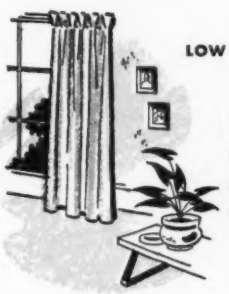

Vinyl drapes plasticized with FLEXOL *DOP are still in service after ten years of constant use.*

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Plastic garden hose containing FLEXOL *DOP does not stiffen through water extraction and withstands long term sunlight exposure.*

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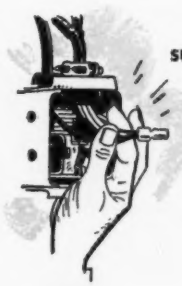

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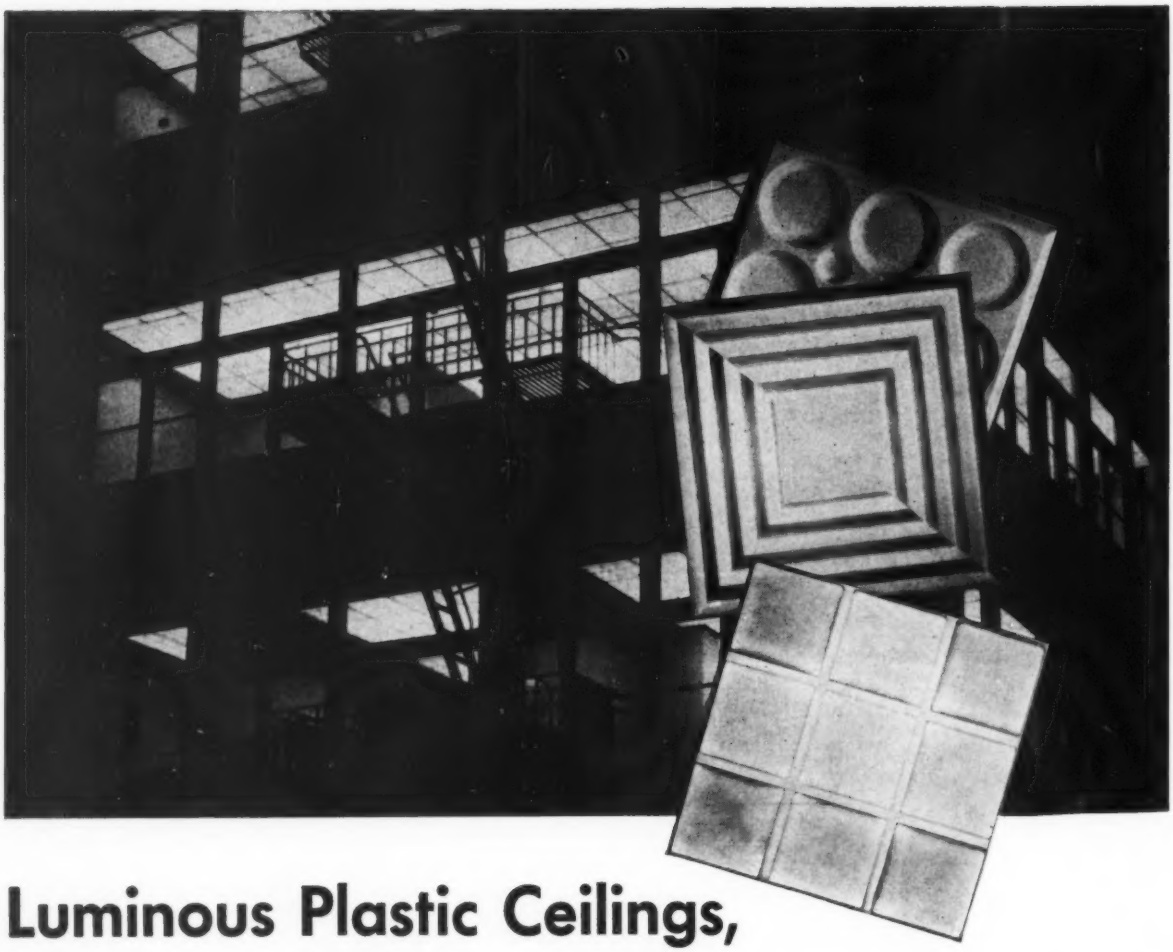

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a slight difference between the curvatures of the flat sample curve and those of cable sheath. The amount of curvature increases as the cable diameter decreases.

The result is the following approximation formula, from which the thickness calibration can be calculated within 0.001 in., with the error negligible over most of the working range:

$$T = T_F K_1 K_2$$

where T = thickness in thousandth's of an inch of polyethylene cable sheath; T_F = thickness of flat polyethylene sample at same recorder meter reading as for T; K_1 = ratio of actual cable sheath thickness to flat sample thickness at zero meter reading; and K_2 = constant to change slope of $T_F K_1$ curve. For +meter readings:

$$K_2 = \frac{T \text{ (at } +35 \text{ meter)} - T_0}{T_F K_1 \text{ (at } +35 \text{ meter)} - T_0}$$

for −meter readings:

$$K_2 = \frac{T \text{ (at } -35 \text{ meter)} - T_0}{T_F K_1 \text{ (at } -35 \text{ meter)} - T_0}$$

T_0 = thickness in thousandth's of an inch of cable sheath at zero meter reading.

The K_1 factor accounts for the dimensional differences between the capacitor formed by a flat thickness of polyethylene on a flat plate compared to the actual capacitor construction of cable at zero meter. Both have the same capacitance of 1.20 mmf. at zero meter reading. K_2 accounts for changes resulting from the curved surfaces of cable. K_1 and K_2 are different for each cable diameter.

Since zero meter is used as a reference point, the formula becomes:

$$T = (T_F K_1 - T_0)\ K_2 + T_0$$

Accuracy Check

A check[3] was made of the accuracy of calibration and of the response under operating conditions of applying the sheath to the cable. The upper graph in Fig. 8 was obtained with the probe tracking at a cable sheathing speed of 50 ft. per minute. The probe was shifted to different octant locations on the circumference for lengths of the cable as indicated on the graphs. The track of the probe was marked on the sheath surface and the sheath then removed, cleaned of flooding compound, and micrometer measurements of thickness taken at 6-in. intervals. The lower graph of Fig. 8 is a plot of thickness measured by micrometer. The ability of the test equipment to track and respond to the thickness variations is apparent.

[3] Test and measurement by courtesy of J. L. O'Toole, Bell Telephone Laboratories.

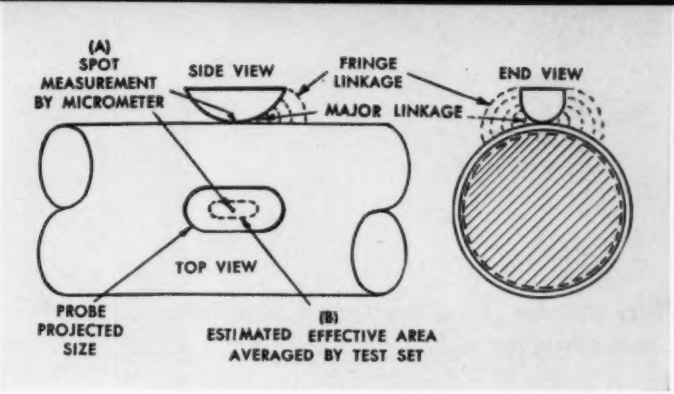

Fig. 6—Gage measured by direct calibration—micrometer spot vs capacitance area

The test set is placed at some distance from the extruder to prevent the probe from marking the polyethylene while it is still soft. Part of the machinery of the sheathing line is diagrammed in Fig. 9. After the cable is pulled from the supply reel through the flood tank where the hot rubber-asphalt compound is flowed over the corrugated metal sheath, it progresses through the die head of the extruder where the polyethylene sheath is extruded over the flooded metal sheath. The cable then enters the cooling trough where the polyethylene outer sheath is cooled and solidified. At the exit of the cooling trough is an air blower for drying the water from the sheath surface. The test set follows the dryer.

Recorder Graph

A typical recorder graph taken along 360 ft. of cable length with the sensing probe held at one lo-

(*Continued on p. 124*)

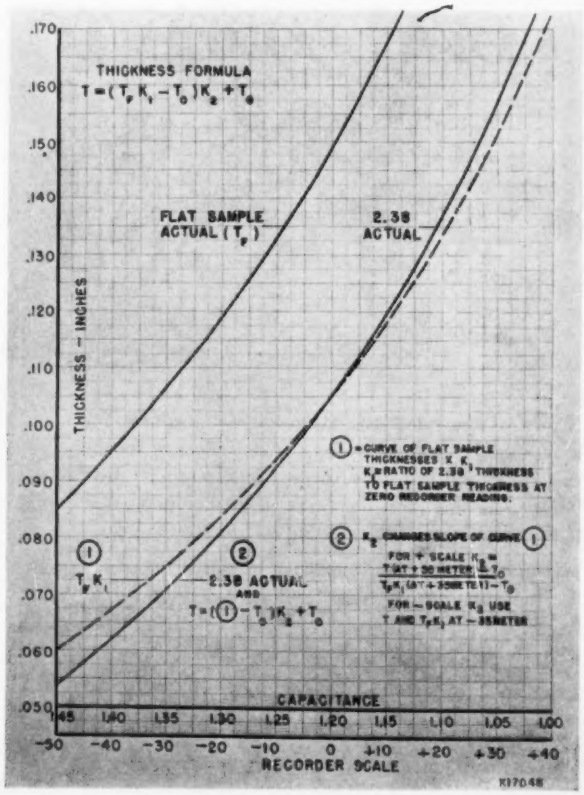
THICKNESS FORMULA
T = (T_F K_1 − T_0) K_2 + T_0
FLAT SAMPLE ACTUAL (T_F)
2.38 ACTUAL
THICKNESS — INCHES
.170
.160
.150
.140
.130
.120
.110
.100
.090
.080
.070
.060
.050
① = CURVE OF FLAT SAMPLE THICKNESSES X K_1
K_2 = RATIO OF 2.38 THICKNESS TO FLAT SAMPLE THICKNESS AT ZERO RECORDER READING.
② K_2 CHANGES SLOPE OF CURVE ①
FOR + SCALE K_2 IS T AT +35 METER − T_0 / T_F K_1 (AT +35 METER) − T_0
FOR − SCALE K_2 USE T AND T_F K_1 AT −35 METER
T_F K_1
2.38 ACTUAL AND T = (①) − T_0) K_2 + T_0
CAPACITANCE
1.45 1.40 1.35 1.30 1.25 1.20 1.15 1.10 1.05 1.00
−50 −40 −30 −20 −10 0 +10 +20 +30 +40
RECORDER SCALE
K17048

Fig. 7—Adjustment of flat sample calibration to obtain calibration of 2.38-in. diameter cable sheath

Parts Molders! *Do you want to fill molds easier without extending cycle time?*

Are you looking for a formulation that can overcome most mold surface "freezing" and sticking conditions?

Are you seeking greater molding tolerances within pressure and temperature limits?

Molded Parts Users! *Want to reduce mold investment through fewer rejected pieces?*

Want finished pieces with greater clarity, better finish and freedom from flow lines?

Want more attractive pieces with better back painting effects due to clearer, smoother surfaces?

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If any of the questions above pose a problem for you, look into Dow's new Styron® 688. This new formulation was developed not only to give better quality products, but also to help you obtain even greater efficiency from the latest advances in molding techniques.

Styron 688 provides improved pressure control within the mold cavity, gives better flow behavior in the cavity which reduces streaking and weld problems—but without increasing cycle. Styron 688 also overcomes most mold surface "freezing" and sticking conditions.

Extensive field testing has proved the advantages of Styron 688. This new formulation is expected to help you exploit new market opportunities for polystyrene molded parts.

For complete physical properties and important fabrication information, write for Dow's new bulletin on Styron 688, THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales, PL 444R.

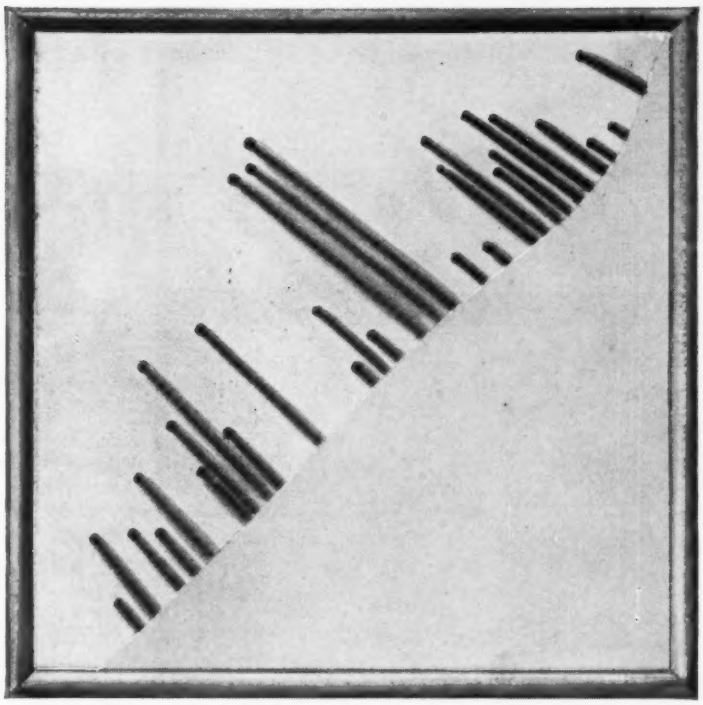

Figure 1. Partially filled mold cavity showing direction of flow from gate in upper left corner. Taken from Dow motion picture studies.

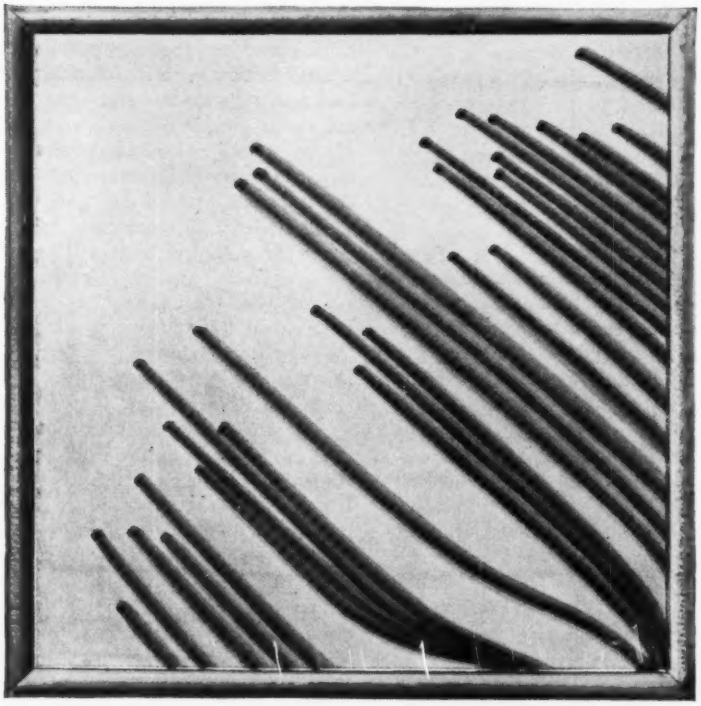

Figure 2. Mold completely filled. Observation of color lines shows flow and pressure changes during filling cycle.

MOTION PICTURE USED TO STUDY MOLD FLOW

Dow has pioneered in the clinical approach to molding problems. Illustrated are studies of flow within a transparent cavity using a viscous solution to make a flow pattern which can be checked against several variables of mold design and pressure conditions. Motion picture studies and many other research tools help Dow engineers develop better plastics materials. One of the latest formulations tailored for new standards of performance is Styron 688.

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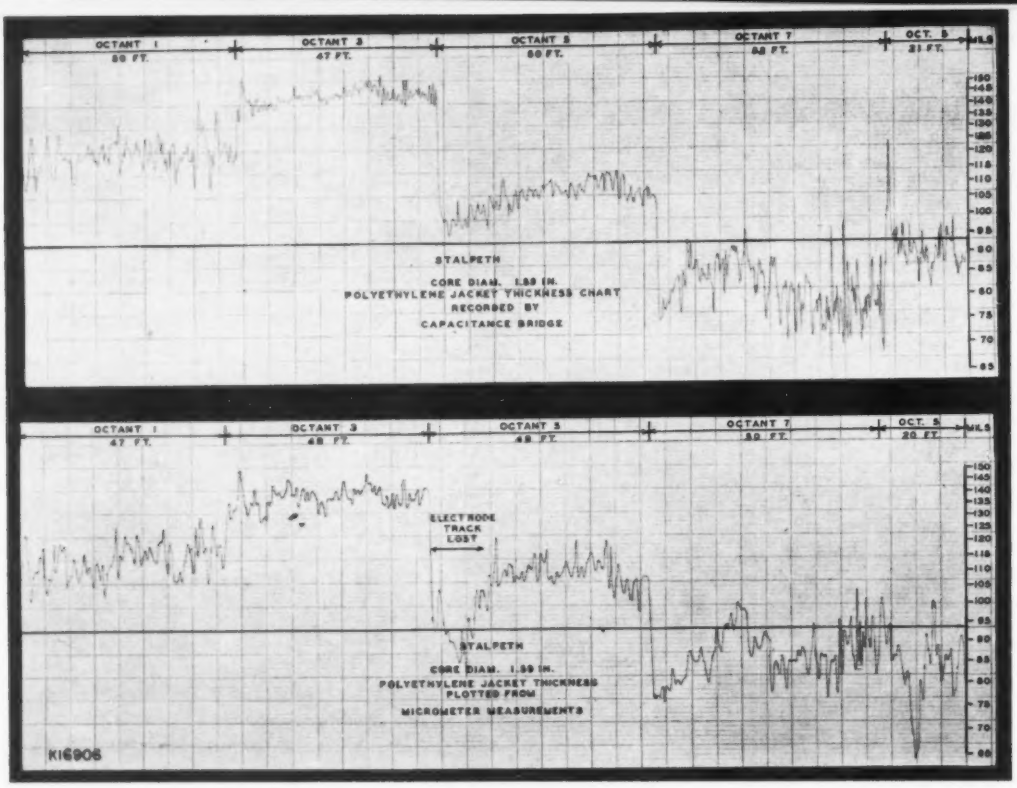


Fig. 8—Results of check, by micrometer measuring method, on accuracy and response of capacitance-bridge gaging

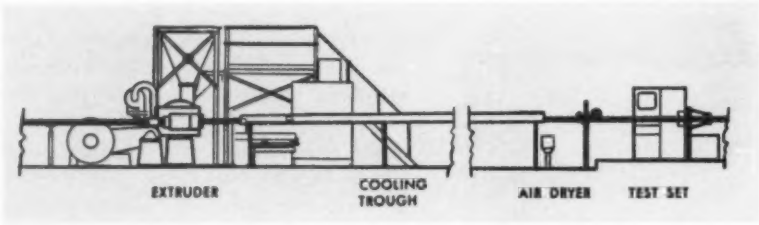


Fig. 9—Diagram of polyethylene sheathing line equipment, with gaging test set

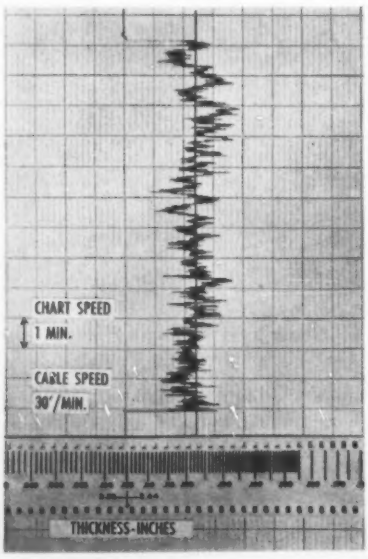


Fig. 10—Thickness gage recorder graph

cation on the sheath circumference is shown in Fig. 10. For die adjustment, thickness measurements are obtained visually by estimating the average of the fluctuations of the recorder's visual indicator. Measurements are taken at quadrant locations corresponding to the locations of the four die adjusting screws. Opposite thicknesses give the amount of eccentricity. Die adjustments can then be made accurately because the amount of eccentricity is known and the amount of die movement is governed by the adjusting screw pitch.

Adjustment to specified average sheath thickness is made by averaging measurements at eight positions equally spaced around the sheath. Increasing the speed of the cable in relation to the speed of extrusion increases the stretch of the polyethylene and decreases the average thickness. Decreasing the cable speed increases the average thickness.

The thickness test provides an accurate gage for the inspection organization to measure compliance of the sheath to specified requirements. Inspection possibilities with the thickness test set are many and the problem becomes one of an economic procedure that will assure the required quality. Continuous recording of the entire cable length is practical but unnecessary from a manufacturing viewpoint. Recorder chart speed is 0.5 in. per min. and cable speeds are from 20 to 100 ft. per minute. It was found that the fluctuations or variation peaks along the cable length could be averaged from chart lengths of ¼ in., and that, by taking measurements consecutively by octants around the circumference, a practical measure of the entire circumference could be obtained which would be sufficient to locate the minimum wall thickness.

Four thicknesses are specified for inspecting sheath, all of which are obtained from a graph of the consecutively recorded octants. These checks are: 1) minimum spot thick-

(*Continued on p. 201*)

Automatic Injection Molding*

Essentials of automatic machinery, plus descriptions of several jobs run on such equipment

by Ernest P. Moslo†

THE fully automatic injection molding machine, regardless of who builds it, must be well designed and well balanced. It must be simple in construction and positive in operation. Functioning of such a machine depends upon a complex co-ordination of three factors—electricity, hydraulics, and mechanics—each of which is equally important.

To ready an automatic machine for production, after the mold is installed, the pyrometers are set for proper temperature control of the heating cylinder. In automatic molding, these pyrometers should be of the proportioning type, to accurately control the temperature of the material. The timers are then set for an estimated production cycle, which is generally a little longer than the final actual cycle required to produce the shot.

To operate the machine automatically, the safety gate is closed and stays closed as long as the machine performs properly. Closing this gate starts the nerve center functioning, with the following results:

Closing the safety gate releases the limit switch which energizes the over-all cycle timer. This immediately energizes the clamp close solenoid valve, closing the clamp. The clamp forward limit switch is tripped, energizing the injection timer which immediately energizes the forward hydraulic solenoid valve. The injection ram advances and is timed by the injection timer until the cycle is complete. The injection timer times out, the injection ram returns and (in many machines) an injection counter timer is energized. The injection ram then advances and returns between the count limit switch and the injection limit switch to repack the cylinder with the amount of material required for the next shot. The number of these strokes is controlled by the setting of the counter timer. After the count limit switch is opened for the last count, the counter times out and the injection ram stops on the forward count limit switch or in the advanced position, ready for its shortest stroke for the next injection. The over-all cycle timer then times out, energizing the clamp open solenoid. The clamp opens, tripping a clamp return limit switch which de-energizes the over-all cycle timer and a repeat cycle pneumatic timer is energized which, after a short pause, closes the clamp again and starts another cycle. The machine continues to function until the gate is opened, the selector switch is turned off, or a jam occurs in the mold due to a part not ejecting properly.

The electrical system has a great bearing on the efficiency, safety, and continued operation of this piece of equipment. It must be of the highest caliber obtainable and standard in the industry. Wiring should be color coded and properly marked. Over-load protection for all units and an electrical panel interlock should be provided for protection of the electrical components, the operator, and the machine.

Hydraulic System

A good hydraulic system begins with the oil reservoir, capacity of which should be at least three times that of the rated capacity of the pump. A baffle is usually placed through the center of this oil tank. The hot discharged oil should enter on one side of the baffle and the intake oil taken from the other side. The capacity of the oil tank is dependent somewhat on the size of the heat exchanger used to cool the oil.

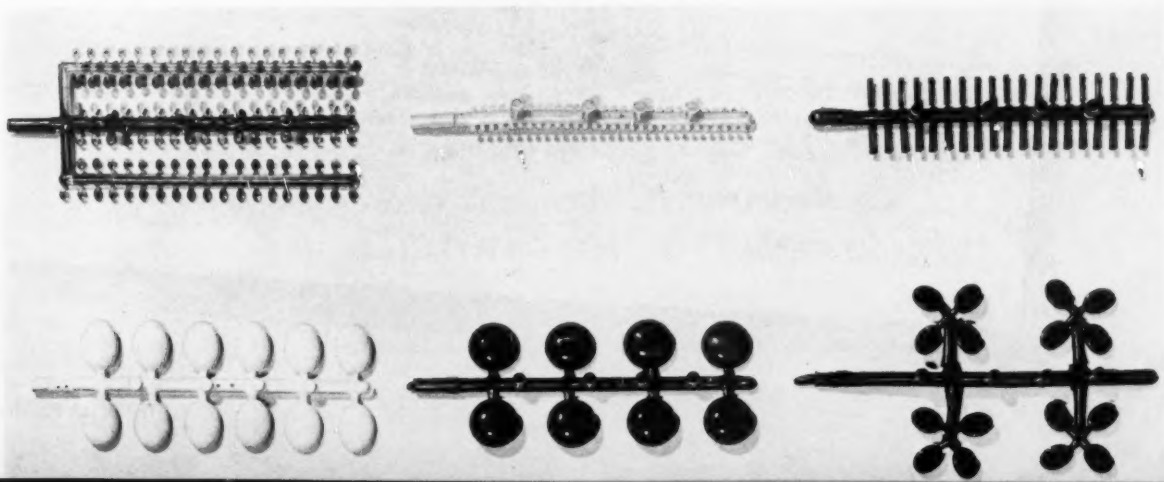
The hydraulic pump must be provided with a proper over-load relief valve, either built into the pump

(*Continued on p.* 128)

*Adapted from a paper presented at the Tenth Annual Technical Conference of the Society of Plastics Engineers, Inc.

†President, Moslo Machinery Co.

Fig. 1—By arranging mold cavity plates of uniform size with identical runner placement and with knockout pins in the same location on all mo'd plates, automatic injection molding of jewelry and novelty items, such as those shown, is greatly facilitated



Statement of Principles by the Plastics Industry

PLASTIC materials challenge industry with new concepts of design, engineering, construction, processibility and usefulness.

The properties of plastic materials, when correctly used, open up great new areas of service to industry and the public.

Improper use can do irreparable damage to the plastics industry, to both manufacturers and processors of the materials.

Therefore, we as manufacturers and processors of plastic materials reaffirm our adherence to the principles upon which the healthy growth of a great industry depends and undertake to:

I Understand thoroughly the properties and limitations of all plastic materials handled by us;

II Apply the correct plastic materials to all industrial end uses, designing and engineering them for maximum value, performance and safety;

III Use great care to select the correct plastic materials for all consumer items, designing and engineering them to insure value, satisfaction, safety and pleasure to all users;

IV Sell plastic materials, and all industrial and consumer items made therefrom, on the merits of the materials, applications and design, and free of extravagant, insupportable claims.

All to the end that plastic materials already available, and others that may come, will bring to industry and public alike all the benefits, economies and satisfactions inherent in these versatile engineering and construction materials.

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Accepted:
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Polychemicals Department
E D Rhes General Manager

In the interests of all who are concerned with the manufacture or purchase of plastic products, Du Pont reproduces here the "Statement of Principles" recently issued by five of the major trade associations of the plastics industry. This document reaffirms the industry's desire to continue to serve more and more people, better and better.

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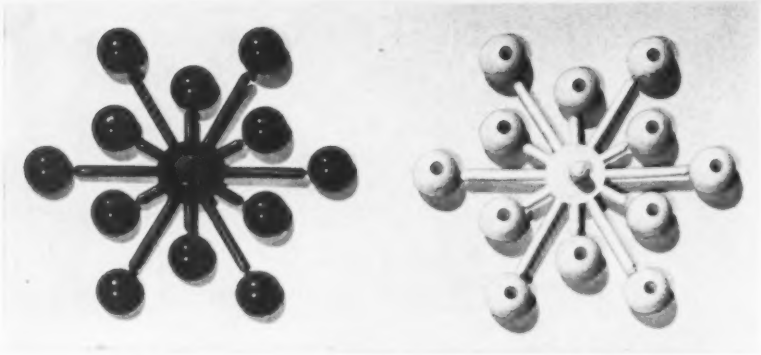

Fig. 2—Radial design of 12-cavity mold used in automatic forming of these fishing floats made necessary individual runners for each part, required 15.1 g. per shot

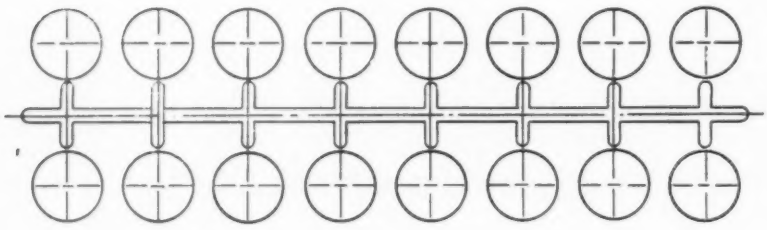

Fig. 3—By redesigning mold so that parts are in parallel rows, shots only a fraction of a gram more than those used for 12-cavity radial mold would fill 16 cavities

or externally provided. Without an over-load relief valve, the pump would continue to build up pressure and stall the motor or ruin itself. The over-load relief valve is usually adjustable and set for the desired or rated operating pressure of this piece of equipment.

Relief Valve

Most machines for automatic molding employ one double-solenoid pilot-operated four-way valve for the clamp cylinder, one double-solenoid pilot-operated four-way valve for the injection cylinder, and one pilot-operated two-way valve for the low-pressure clamp system. Different valving systems, however, are used by various manufacturers.

A must on automatic injection molding machines is an adjustable relief valve placed in the line leading to the pressure end of the injection cylinder. With this valve, pressure is controlled on the material being injected into the mold without affecting the oil pressure on the rest of the hydraulic system.

Hydraulic piston and rod packing should have an adjustable packing gland for take-up, in case leaks occur. Adjustable cushions on the end of the stroke are an asset to prevent banging at very high speeds.

An automatic machine must have an over-sized plasticizing chamber. Frequently, after finding out how much the machine will shoot at one time and how fast the machine will cycle, a molder will start to figure a job, completely forgetting about the amount of material the plasticizing chamber is able to produce. This can mean trouble. The molder must consider the plasticizing capacity of the machine, the total projected clamping area the machine will mold, and the speed of the machine.

Feed Mechanism

An automatic machine must be equipped with a good compensating feed mechanism, as it is important to feed the proper amount of material for each and every shot. Should the feed be erratic, pressure variations will result from shot to shot. Pressure, of course, is created by the amount of material in front of the piston. If this varies, pressure varies; if pressure varies, sticking will often occur in the mold. With shots that have little build-up in front of the piston, the mold cavity will be packed too tightly. With this condition, parts are apt to stick. With a large build-up of plastic in front of the piston, short shots often occur. An even feed aids constant production.

To facilitate removal of parts from an automatic mold, it is desirable to have a slight time delay when the mold clamp is fully open. An air-blast valve, operated on the opening of the mold, is an asset. At times it is well to connect the air directly to the cavities to remove parts.

Safety Device

Most high speed automatic machines have a built-in safety device which consists of the two pressure oil systems mentioned earlier. If a part, or even flash a few thousandths of an inch thick sticks in the mold, the machine ceases to function. Even when using soft metal molds or cast beryllium molds, no damage is done to the mold if the machine is equipped with such a built-in safety device and if it is properly adjusted.

The mold clamp is closed under very low pressure until the faces of the mold themselves meet. At this point a Micro-switch is contacted, high-pressure oil is directed to the

Fig. 4—Good mold design is shown in this 12-cavity family mold run on 8-sec. cycles

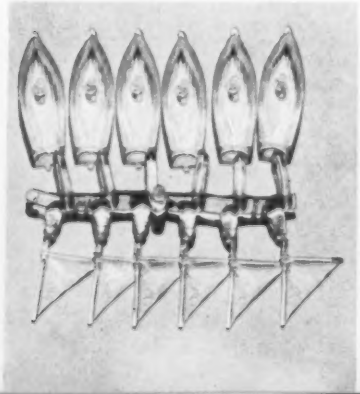

Fig. 5—Group of medallions is molded fully automatically in mold with 3-plate construction

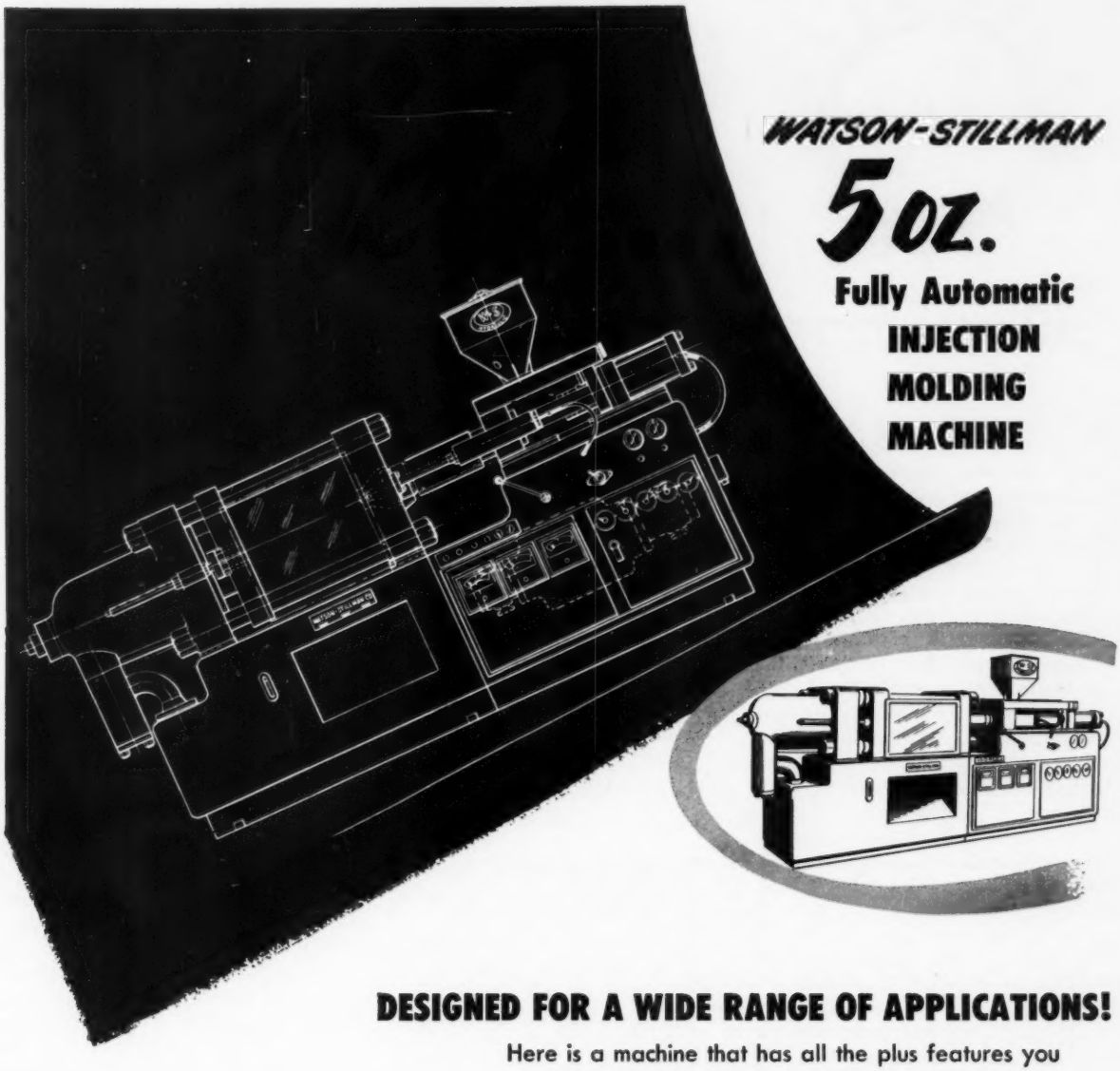

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Fig. 6—Experimental shot produced in mold with sprue bushing removed

cylinder, and the mold is clamped. However, if a part or flash is left in the mold, the Micro-switch is not tripped and, as a result, the clamp does not toggle out. Normally, an additional timer is wired in the circuit. This timer is set high enough so that during normal automatic cycling, it never times out. However, if a part is stuck in the mold, the timer does time out. This stops the machine from cycling and sets up a circuit to a red indicating light which flashes, drawing the operator's attention to the fact that something is stuck in the mold.

Mold design for automatic operation is very important. For example, the Henry Lewis Co., Attleboro, Mass., using a battery of 2½-oz. Moslo high-speed universal injection molding machines, has worked out an unusual mold design. Being a proprietary molder, principally of jewelry and novelty items (Fig. 1) it was possible for that company to arrange mold cavity plates of a uniform size with identical runner placement, knockout pins being in the same location on all mold plates. Mold shoes remain in the machine at all times. To change molds, clamp strips are removed, the mold cavity plates are lifted out, new cavity plates are inserted into the mold frames, and the machine is ready for operation in a matter of minutes. This same molder drills cavity plates for water, which allows the water to run out of the bottom of the mold and wash the finished parts down the machine discharge chute into a water cooling pan.

Radial Mold

An excellent example of parts produced by automatic molding is a fishing float (Fig. 2) produced in a 12-cavity mold, the shot weighing 15.1 grams. This job is being run on a Moslo Model 73 fully automatic 2-oz. machine at the rate of 400 shots per hr. by the B.O.K. Co., Dayton, Ohio. However, the mold is an example of bad design. Since the parts are placed radially, individual runners are required for each individual part. Were these parts placed in two parallel rows (Fig. 3) in the mold, a shot for 16 cavities would weigh 15.5 g., or only 0.4 g. additional.

Another example of a good automatic molding is a family mold of 12 cavities (Fig. 4). The shot weighs approximately 19½ g. and is being run fully automatically on long production runs on an 8-sec. cycle or 450 shots per hr. on a 3-oz. Fellows machine by Thomas Manufacturing Co., Newark, N.J. Because of the fast cycle, it has been found that best results were obtained when the molded parts were dropped directly from the mold into a water tank.

Another job on a 3-oz. Fellows, being run at the Ford Rotunda in Detroit, is a group of medallions (Fig. 5) produced in a mold of three-plate construction. This mold will not run as fast as a mold with ordinary gating, but still the job is run completely and fully automatically. There is one advantage to three-plate mold construction, and that is that the parts are automatically degated and are ready to be boxed for shipment. The disadvantage of three-plate mold construction in automatic molding is getting not only the parts but also the runners out of the mold and having it cleared for subsequent molding operations.

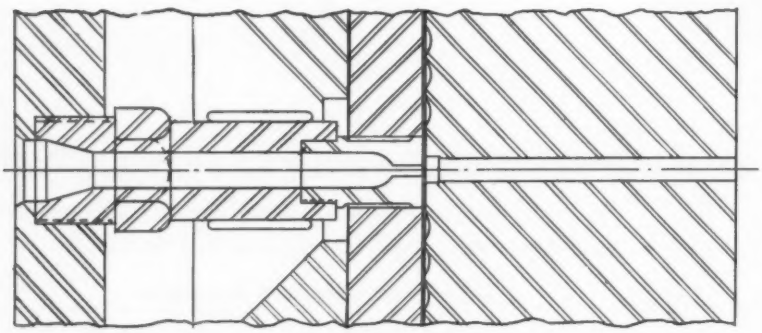


Fig. 7—Special nozzle, designed for use with ring-gated mold (see shot in Fig. 6), has flat-ended, 1-in. extension. End of nozzle extends to end of parting line of mold

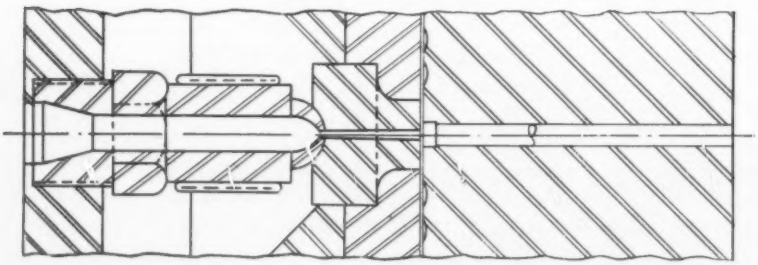


Fig. 8—Conventional nozzle, first used to run same ring-gated mold, required considerably higher cylinder temperatures than those with nozzle design shown in Fig. 7

Design of Mold

Mold design is of utmost importance in automatic molding. Many molds are in operation in which the parts are automatically degated on the opening of the mold, gates and runners being automatically sorted from the finished molded pieces. For such work, molds must be accurately made, cavities well polished, and all under-cuts eliminated to make possible positive ejection of the parts. Knockout pins should be strategically located and, in many cases, a stripper plate can also be used to very good advantage in automatic injection molding.

The writer has recently concluded

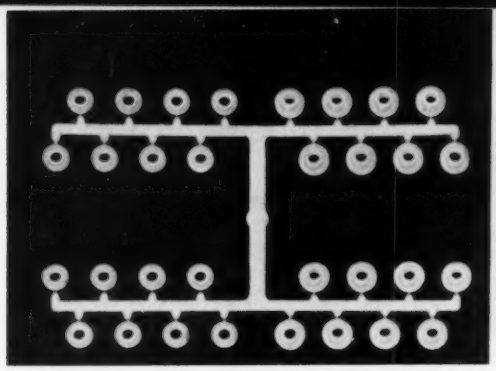


Fig. 9—Nylon shot, automatically molded on a 4-oz. machine, weighs 34.6 grams. Molding cycle was 25.7 seconds

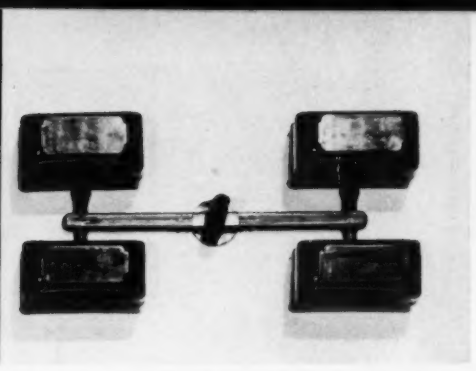


Fig. 10—This nylon shot, molded on an 8-oz. machine on 18-sec. cycles, weighs 65.8 grams

an experiment on a 20-cavity ring-gated mold producing little plastic leaves (see Fig. 6), from which the sprue bushing was completely removed. A special nozzle with an extension 1 in. in diameter, with a flat end, was installed in the machine. The end of the nozzle extended to the parting line of the mold (Fig. 7). The 1-in. diameter was relieved directly back of the end of the nozzle $\frac{3}{32}$ in. to eliminate cooling transfer from the cold mold plate to the nozzle. The nozzle had approximately a $\frac{5}{32}$-in. diameter opening. This opening was tapered for $\frac{3}{8}$ inch. The rest of the nozzle was of standard construction. The nozzle itself had a heating band within approximately 1½ in. of the end.

Nozzle Set-Up

This mold had been run with a conventional nozzle (Fig. 8) just prior to this experiment. The three pyrometers were set as follows: 445° F. for the rear pyrometer, 440° F. for the front pyrometer and 445° F. for the nose pyrometer. Oil pressure was set at a maximum of 1250 p.s.i. The machine was operating on a 4½-sec. cycle, producing 800 finished shots per hr., or 16,000 molded pieces per hour. The experimental nozzle was installed in the machine and the machine started up, with the oil pressure maintained at 1250 p.s.i. After a lengthy experimental run, during which time the cylinder temperatures were gradually reduced, it was found that parts of equal quality could be produced with cylinder temperatures as low as 400° F. on the front and rear and 380° F. on the nozzle.

The advantages of this nozzle set-up are many. By injecting the plastic material at lower temperatures, less strain occurs and better dimensional stability is attained. The material, not being so hot, requires a shorter cure. Possiblity of flashing is considerably reduced and sprue waste is eliminated. On many parts where the machine is not operating at or near top speed, production can be greatly increased.

This experiment was conducted on a Moslo Model 73 fully automatic 2-oz. machine, and shots were made on a cycle as short as 3½ sec., or 1025 shots per hour. This gives an excellent idea of the potential of fully automatic injection molding. There aren't too many parts that can be run at this high speed, but there are definitely some thin wall jobs that can be produced this rapidly.

Some other parts produced on high-speed automatic plastic injection molding machines are shown in Figs. 9 and 10. The shot in Fig. 9 was molded from nylon on a Lester 4-oz. machine by General Motors Corp. The cycle was 25.7 sec., or 140 shots per hour. Weight is 34.6 grams. The shot in Fig. 10 was molded from nylon on a Lester 8-oz. machine, 18-sec. cycle, 200 shots per hour. Weight is 65.8 grams.

The chair leg tips (Fig. 11) were made from polyethylene on a Moslo 4-oz. machine, in a 20-cavity mold. The weight per shot is 5½ oz., which proves that some machines can shoot more than the rated capacity. The part was made by the A.S.K. Mfg. Co., Philadelphia, Pa.

Advantages

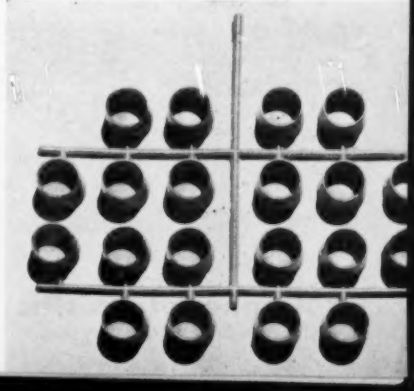
There are many advantages to high-speed automatic molding on a well designed machine Mold cost is lower, initial equipment cost is lower and one operator can operate at least three machines. There is also considerable saving of floor space.

Molds with fewer cavities, operating at high speed, turn out greater production. Instead of the molder having the mold built with a large number of cavities to be run in a large machine, it is often to his advantage to build a mold for high-speed automatic molding with fewer cavities.

There aren't nearly as many variables in fully automatic molding as in semi-automatic operation. The safety gate is kept closed, thus eliminating the human element. The plastic being injected into the mold is of an even temperature on each shot. With constant feed, pressure on material is uniform, quality is constant, and the danger of flash is practically eliminated.

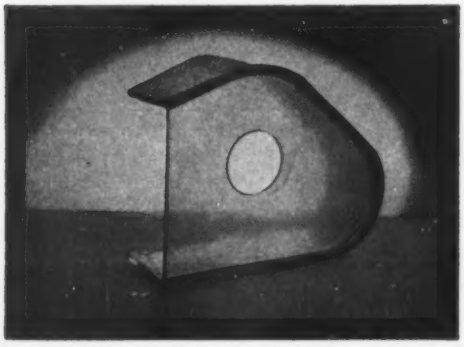
There is still a lot that the manufacturer of automatic plastics injection molding machines as well as the molder and the mold maker must learn. With free interchange of ideas, better equipment and better molds can be built, making it possible to produce better parts at a lower cost. In time to come, there is no doubt that the injection machinery manufacturers, with cooperation, complaints, and ideas from molders, will produce even better and more successful fully automatic plastics injection molding machines.

Fig. 11—Polyethylene shot of 5½ oz. was molded on 4-oz. injection machine
Photos courtesy Moslo Machinery Co.

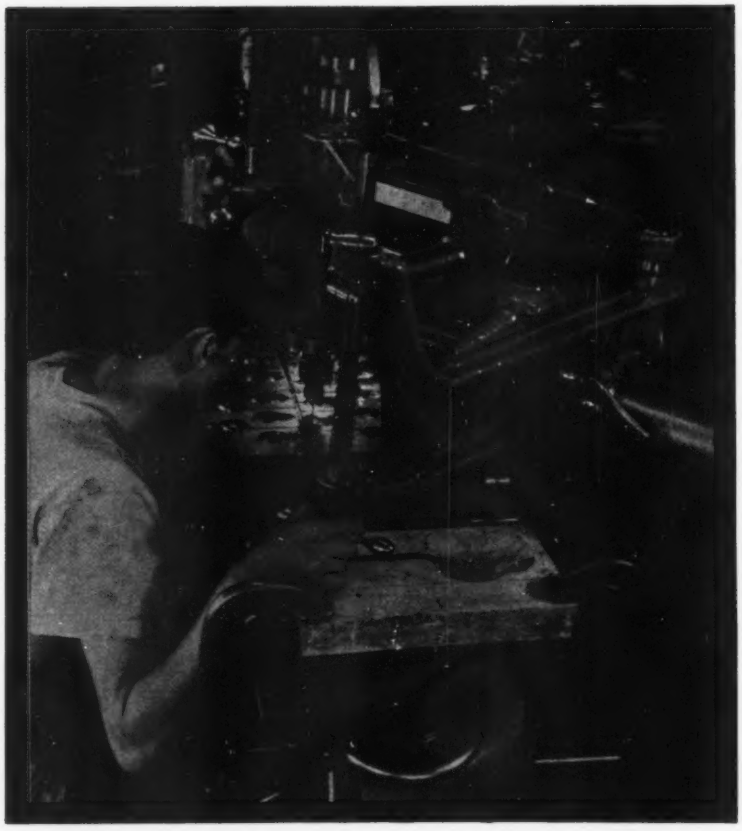


Mold used for contact lamination of fiber glass impregnated with polyester resin. Resin #78 is resistant to heat, will not crack or distort.

Cast stretch-die used in forming aluminum aircraft parts. The high compressive strength of Marblette's resin #71 makes it particularly adaptable to this operation.



Transparent gear housing cast from Marblette phenolic resin #88 demonstrates the excellent light transmitting properties of the Marblette compound.



The stylus of the pantograph is moved over the contours of the pattern, made of Marblette resin #71, reproducing it with complete accuracy in the multiple cavity steel die in the background.

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Heat-Resistant Silicone Foams

by D. E. Weyer† and K. R. Hoffman†

In recent years considerable emphasis has been placed upon the development of expanded plastics, not only as a result of the increased use of the materials themselves, but also for the preparation of lightweight sandwich structures for aircraft. Leading manufacturers have made many highly developed resins available for the production of foams. Their physical properties in the expanded state are varied, permitting their extensive use in aircraft and building construction, as thermal and electrical insulation, and in buoyancy applications.

These materials have a sufficient ratio of compressive strength to weight to satisfy their present applications. However, none of them appears able to keep up with current and future developments in high-speed, high-temperature aircraft and guided missile requirements. Top continuous operating temperature of the thermoplastic materials is about 200° F., thermosetting plastics are limited to about 350° F.

To overcome this drawback, the Air Force[1] initiated a program to develop new low-density resinous foamed-in-place core materials with the desirable physical properties of the organic foams, together with a degree of thermal stability that would allow them to be used continuously at 500° F. and intermittently at higher temperatures.

A large number of silicone resins were evaluated under this program. Two resins were finally chosen as exemplifying the best physical properties in the expanded state and are now commercially available. Finished foams based on these resins will be on the market soon.

Known as XR-543 and XR-544, both resins produce exceptionally heat-stable foams. Their expansion can be controlled to produce a wide range of densities. They may be cast in blocks or sheets, made up as sandwich structures, or foamed in place. Both resins produce a uniform, multi-pore foam structure, with each pore spherical and unicellular. Although complete investigations have not been made, it is known that the resins are compatible to a limited extent with small quantities of certain alkyds, phenolics, and urea-formaldehyde resins. After proper curing, the foams can be carved or cut to almost any shape with woodworking tools.

Both resins are expanded in the same manner. However, the foams made from resin XR-543 are somewhat thermoplastic and become pliable and resilient at elevated temperatures. The degree of softness is a function of postcure. Sections of these foams can be heated until pliable and formed to almost any shape. Further postcuring of the formed foam strengthens the structure and overcomes most of the thermoplasticity.

In contrast, the foams made from resins XR-544 are very rigid and retain a good percentage of their original compressive strength when heated to 500° F. Most of the properties listed below are for the foams made from resin XR-544.

Illustrations courtesy Dow Corning Corp.

Fig. 1—Silicone foam resins are originally supplied as 100% solids. The crumbled solids are quickly liquefied in 250 to 300° F. oven

Preparation of Foams

The resins are expanded simply and easily in four basic steps: melting the resin, blending the reagents, expanding the mixture, and curing the foam. The blowing agent used is largely nitrogen, although traces of formaldehyde and various amines are given off in the process. The fumes evolved, however, are not particularly toxic. Since foaming action is endothermic and slow, there are no critical time limits or atmospheric conditions to affect the action.

The resin is supplied as a crumbled solid. Its shelf life in this state is apparently quite long since no samples have been lost in the year and a half of this work. To permit the blending of reagents, the solid resin must be melted. For small experimental batches, the resin is melted and heated in an oven until the entire mass reaches a uniform blending temperature (Fig. 1).

The temperature of the melted resin during blending should be over 250° F. and less than 300° F. At 250° F., the viscosity of the melted resin is around 8000 poises, or too high for uniform mixing. At a little over 300° F., the blowing agent, Unicel ND[2], starts to decompose. Although the action is slow, the alkalinity of the decomposition products shortens the pot life of the

* Reg. U.S. Pat. off.
† Product Engineering Laboratories, Dow Corning Corp.
[1] Materials Laboratory, Directorate of Research, Wright Air Development Center., Dayton, Ohio.

[2] E. I. du Pont de Nemours & Co., Inc.

Fig. 2—Foaming agent is added to molten resin which has been whipped to creamy mass in bowl surrounded by heating mantle; further heating for 2 to 3 min. results in a uniform blend

melted resin. Pot life at 300° F. is about 1.5 hours. This temperature may be maintained during mixing by using any type of controllable heating apparatus, such as a hot plate, a heating mantle, or a steam-heated mixer. A steam-heated mixer can be used effectively to eliminate oven melting of the solid resin and to maintain a constant temperature during the mixing cycle.

After the resin has been whipped into a creamy mass, the predetermined quantity of powdered blowing agent is added. A uniform blend is obtained in about 2 to 3 min. of mixing. Mixing time is not critical, but a homogeneous dispersion is important for a uniform cell structure (Fig. 2).

The next step is the addition of catalyst. Since the alkalinity of the decomposition products of Unicel tends to catalyze the resin as expansion takes place, foams may be produced without any additional catalyst. It has been found, however, that the strength and uniformity of the finished structures were substantially increased by using small concentrations of catalyst XY-15[3]. The catalyst may be added separately or simultaneously with the blowing agent. Mixing is continued for another 2 to 3 minutes. The pot life of the resin mix at this stage is about 1 hr. at 300° F.

When the reagents have been uniformly dispersed into the resin, the liquid mix can be transferred to a suitable preheated container for expansion (Fig. 3). Since the mix is still liquid, it may be poured or sucked into small openings to be foamed in place to fill irregular cavities.

The temperature of expansion depends upon the desired density of the foamed resin, which in turn also depends on blowing agent and catalyst concentration. A dense foam, around 21 lb./cu. ft., can be made by expanding the resin at 320° F. With some adjustments in blowing agent and catalyst concentration, a very light foam, 6 to 7 lb./cu. ft., can be made at 355 to 365° F.

All the factors involved in the determination of density for both

[3] Dow Corning Corp.

Fig. 3—Liquid mix, with ingredients thoroughly blended, is poured into suitable preheated container—in this case an open pan lined with aluminum foil to prevent mix from sticking

XR-543 and XR-544 resins are presented in Table I. The work to date has been directed toward producing foams in the density range of 10 to 20 lb./cu. foot. Data on very low-density foams are limited. However, it is known that gelation and expansion must be synchronized. If gas evolution lags behind gelation, a high-density foam results. But when the reverse occurs, the foam collapses or develops a non-uniform cell structure.

The maximum height of the foam is reached and gelation of the resin occurs in about 1 hour. At this point the foam is soft and sensitive to changes in temperature. If the foam is cooled to room temperature, there is a partial collapse. If the tempera-

Table I—Processing Temperatures, Quantities of Blowing Agent, and Catalyst Required to Produce Various Foam Densities

	Foam density sought, lb./cu. ft.				
	8-10	*10-12*	*14-16*	*16-18*	*18-20*
Dow Corning XR-543 Resin					
Mixing temperature, °C.	140-150	130-140	130-140	130-140	130-140
°F.	284-302	266-284	266-284	266-284	266-284
Unicel ND, % by wt.	3	3	3	3	1.5
Catalyst XY-15, cc./300 g.	0	0	1	1	2
Expansion temperature, °C.	180	170	160	150	150
°F.	356	338	320	302	302
Dow Corning XR-544 Resin					
Mixing temperature, °C.	130-140	130-140	130-140	130-140	120-130
°F.	266-284	266-284	266-284	266-284	248-266
Unicel ND, % by wt.	3	3	2	1.5	1.5
Catalyst XY-15, cc./300 g.	0	1	1	1	2
Expansion temperature, °C.	170	160	150	150	140
°F.	338	320	302	302	284

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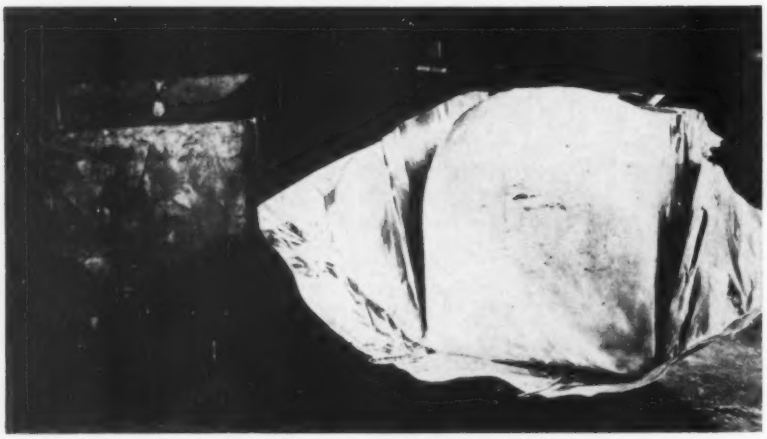


Fig. 4—After precuring, foam is easily stripped from mold and foil liner and is returned to oven for final postcuring. Optimum postcure is achieved in 80 hr. at 480° F.

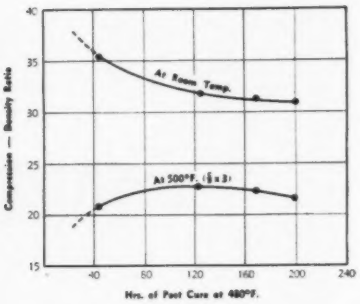
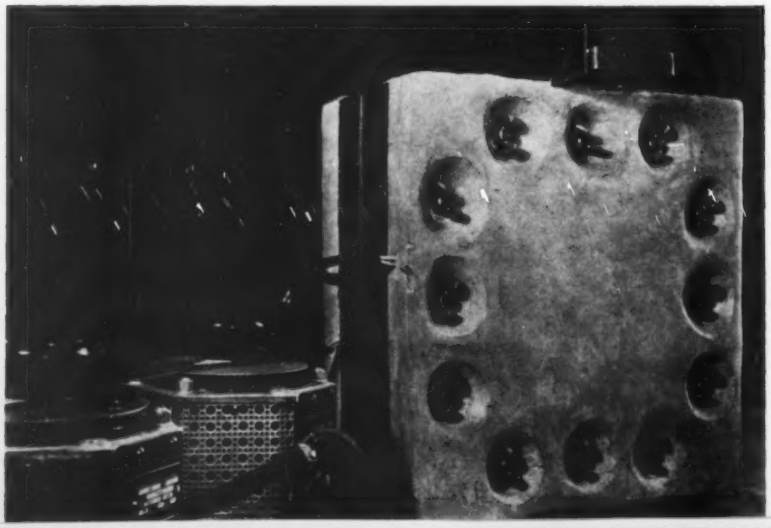


Fig. 5—Curing time effect on compression-density ratio of XR-544

Fig. 6—If sandwich panels are to be prepared, laminate skins are first laid in position within the halves of a heated press (see also Figs. 7 and 8) and then brought up to temperature

Fig. 7—The resin mix is poured into one-half of the mold. In laboratory procedure, the mix is not spread out to the very corners. Instead, the unfilled edges are cut off later

Fig. 8—Secured, the press is placed on edge to permit the resin to flow and cure in place of its own weight, rather than through exterior heat and pressure. Foam density may be varied from 12 to 18 lb. per cu. ft. by adjusting curing time and temperature



ture is elevated for the postcure, the cells become distorted and elongated. To strengthen the gel, therefore, it has been the practice to expose the foam to the expansion temperature for at least 6 hours (Fig. 4). This precure was arbitrarily chosen for continuity of experimental results. It is entirely feasible to shorten the precure time to 2 or 3 hr. without excessive damage to the foam structure.

The optimum postcure for silicone foams may be determined according to the curve presented in Fig. 5. To compensate for small variations in density, the ratios of compressive strength to density are plotted against curing time. Maximum room temperature compression-density ratio occurs after 24 hr. postcure at 480° F., and decreases very little after 80 hr. exposure. The compression-density ratio at 500° F. reaches its maximum after 80 hr. postcure at 480° F. Therefore, the optimum postcure for both cases is considered to be 80 hr. at 480° F. The graph also shows that there is very little decrease in compressive strength of the foams after 200 hr. exposure to 480° F. The postcure can be adjusted.

Sandwich Cores

Most of the program to date has been devoted to the development of acceptable open-pan foams. The production techniques for foamed-in-place sandwich structures have not yet been thoroughly investigated. The main obstacle to the production of uniform sandwich cores is the difference in thermal expansion between the foam and the laminate skin. The linear coefficient of thermal expansion of the foam is 105 $\times$ 10^{-6} per degree Centigrade. Skins so

(*Continued on p. 141*)

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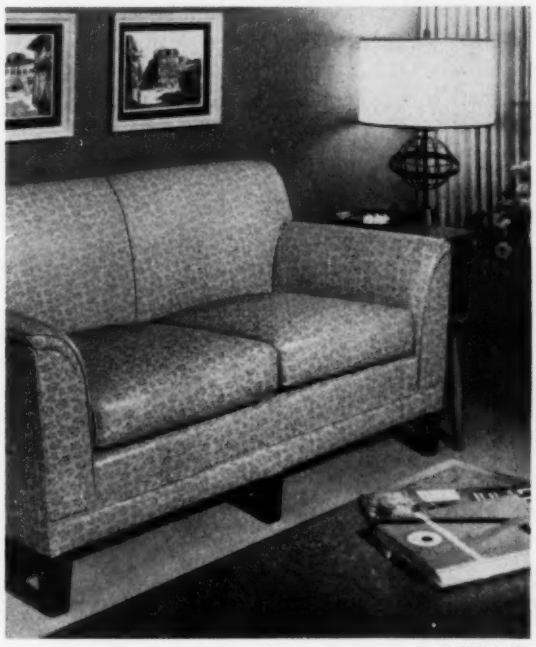

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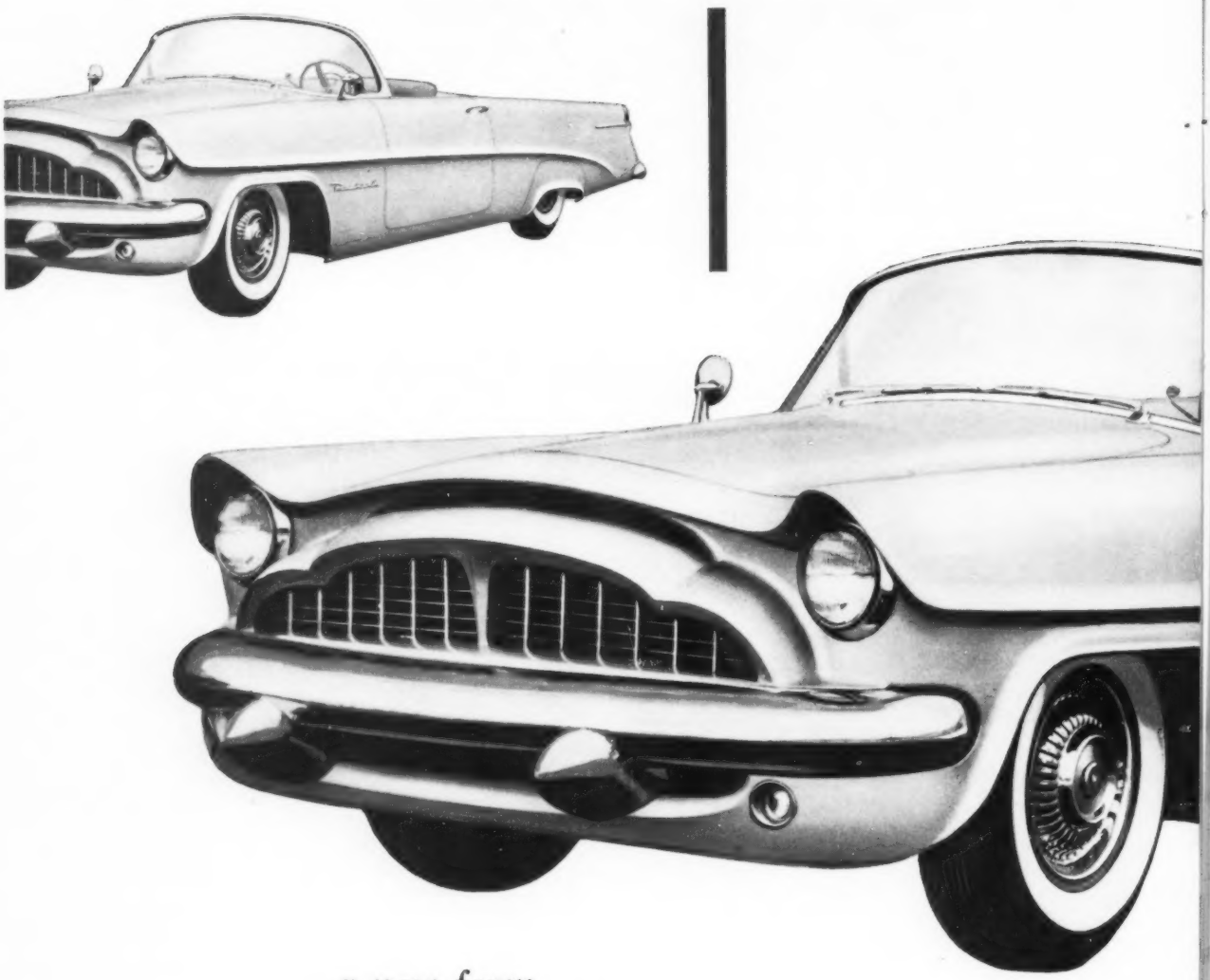

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far evaluated, consisting of 3 layers of 181 glass cloth low-pressure bonded with a silicone resin, have a linear thermal expansion factor in the order of 61 × 10^{-6} per degree Centigrade.

However, it has already been demonstrated that it is possible to produce acceptable sandwiches with cores of XR-543 through the employment of certain simple coating techniques which are still experimental. Highly improved sandwiches based on XR-544 have also been made by including in the resin an inert filler such as diatomaceous earth. Now that most of the basic problems in developing the foam itself have been resolved, it is expected that the engineering difficulties encountered in preparing uniform sandwich panels will be overcome shortly (Figs. 6 to 8, p. 136).

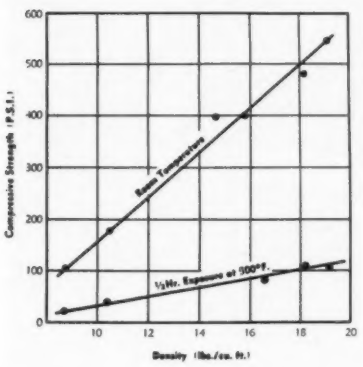

Fig. 9—Compressive strength-density curves for resin XR-544 foams

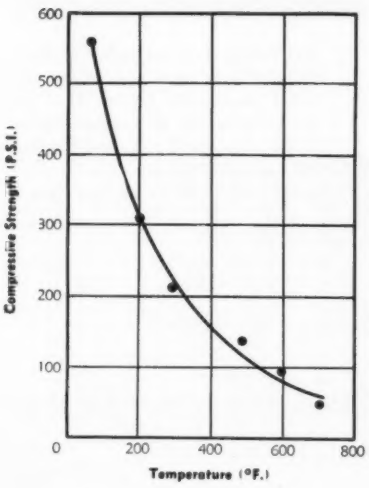

Fig. 10—Compressive strength of resin XR-544 foams (20-lb./cu. ft. density) after ½-hr. temperature exposure

Properties of Foams

The compressive strength versus density of the foams made from silicone resin XR-544 is shown in Fig. 9. One of the primary objectives of the Air Force program was to produce a foam that would have a flatwise compressive strength of 100 p.s.i. at 500° F. It can be seen from the graph that this requirement is satisfied by open-pan foam with a density of 17.5 lb./cu. foot. There are indications that both curves deviate upward from the straight line function after 20-lb./cu. ft. density.

Although designed for eventual use as core material for sandwich structures, silicone foams themselves, made from either XR-543 or XR-544, will withstand 700° F. for 10 hr. without noticeable decomposition. The most heat-resistant organic foams show definite decomposition after about 2 hr. at 350° F. The graph presented in Fig. 10 illustrates the fact that a cured silicone foam made from XR-544 with a density of 20 lb./cu. ft. is not only stable at 700° F. but also retains a compressive strength of 50 p.s.i. after ½-hr. exposure at that temperature.

The heat distortion temperature of silicone foams has been deter-

(*Continued on page 202*)

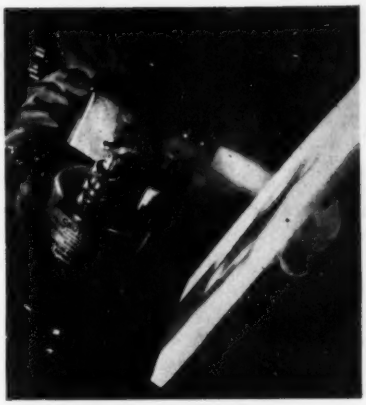

Fig. 11—Thermal insulation of silicone foam is so high that one side of a slab of foam can be heated cherry red with a blow torch without making the other side too hot to touch

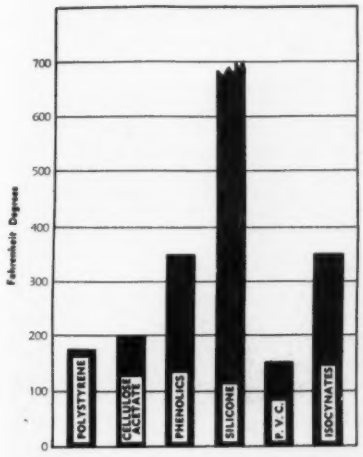

Fig. 12—Heat resistance limits of plastics foams to points of distortion

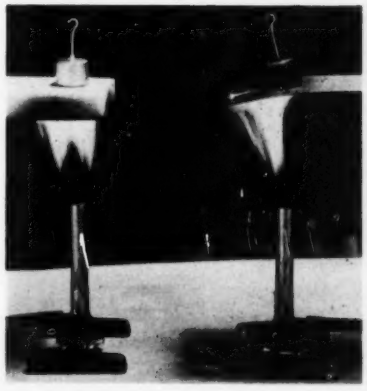

Fig. 13—Lead weight atop section of silicone foam (left) is unaffected by the heat of a Bunsen burner flame. Aluminum sheet of same weight as section of foam does not prevent heat from melting lead weight atop it

Table II—Electrical Properties of Silicone Resin XR-544 Foams at 8.5 KMC.

Foam density	*Electrical property*[a]	*Temperature of measurement* 25°C.	100°C.	200°C.	250°C.
lb./cu. ft.					
14.8	K	1.28	1.30	1.33	1.35
	TAN	0.0010	0.0012	0.0012	0.0016
15.5	K	1.29	1.31	1.34	1.35
	TAN	0.0015	0.0014	0.0019	0.0017
17.15	K	1.33	1.37	1.39	1.41
	TAN	0.0027	0.0014	0.0016	0.0015

[a] K = dielectric constant; TAN = dielectric dissipation factor.

Factors in Electrical Insulator Design

by W. Carl Wikstrand*

THE potential at which electrical failure or breakdown occurs in a material is usually measured according to standard tests, such as those specified in A.S.T.M. Method D 149-44. The methods commonly used are the "short-time" test, wherein the potential applied to a specimen is raised at the rate of 500 v./sec. until breakdown occurs, and the "step-by-step" test, in which a potential equal to 50% of the short-time test value is applied initially and raised in increments of equal size and duration, stepwise, until failure occurs. Results can be given as breakdown potential in volts for a specimen of known thickness, or as dielectric strength in terms of potential per unit thickness.

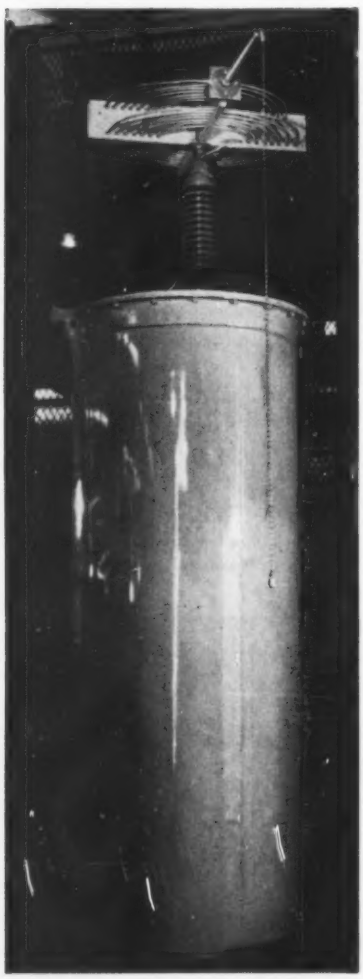

Fig. 1—One-hundred kilovolt test transformer with test lead (chain) and auxiliary coil on output terminal of transformer. Coil is used for dissipating spurious frequencies. High voltages obtained from this transformer are applied to test specimens

Although satisfactory to insure control of quality of a particular product, neither of these tests is of sufficient duration to permit reliable estimation of most service behavior. Consequently, dielectric strength data acquired by standard procedures cannot generally be directly applied to service problems.

The resistance to electrical breakdown of most insulating materials is adversely affected by increases in temperature, thickness and time of application of voltage. Of these, temperature and thickness effects at short times can be measured readily, whereas the time involved in extended endurance testing becomes prohibitive. Many attempts have been made to express the time-potential relationship mathematically, so that all variables would be accounted for, but most formulas hold for only limited conditions. One of the simplest and most useful, which applied reasonably well for the conditions used in this investigation, is that derived by F. W. Peek.[1]

In spite of the improvements that can be made by taking time, temperature, and thickness into account, several differences still remain between most service applications and the tests described below. In this work, the tests were carried out on ideal flat specimens of the plastic, applying the potential under oil by means of electrodes of standard designs (Figs. 1 and 2). Even though these conditions are rarely encountered in practice, the data obtained will be greatly superior to the application of estimates based on quick tests at room temperature.

The molding materials studied were Melmac 1502 and compound A, cellulose-filled melamine-formaldehyde materials, and Compound B, a general-purpose phenolic material. Disks were molded according to the standard molding cycles procedures.

Fig. 2—Oil-filled test tank with heating coil and steam supply for elevated temperature testing. Lead attached to handle of specimen holder is that shown in Fig. 1. Test disk has been inserted between the 1-in. diameter electrodes of specimen holder

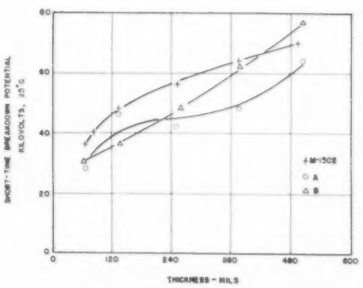

Fig. 3—Short-time breakdown potential versus thickness of melamine (M-1502 and A) and phenolic (B)

Short-Time Tests

The breakdown data plotted in Fig. 3 are the averages of results obtained from five specimens per

(*Continued on page* 203)

* Physicist, Physical Testing Laboratory, Analytical and Testing Div., Stamford Laboratories, American Cyanamid Co.

[1] A.I.E.E. *35*, 738 (1916).

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

THE FARNBOROUGH AIR SHOW. Plastics (London) *18*, 347-49, 354 (Oct. 1953). Details are given of the plastics exhibits at the 1953 exhibition of the Society of British Aircraft Constructors. The exhibits show the important contribution plastics are making in this field. Polyester resins reinforced with glass fibers and phenolic asbestos laminates are being used in structural parts. Transparent acrylic materials are used in canopies with various types of attachments. For internal fittings, opaque acrylic materials find many uses and polyvinyl chloride film is used for panelling in cabins. Foamed materials, with their great strength-to-weight ratio, are used in internal bulkheads and flooring.

THE MOTOR SHOW REVIEWED. Plastics (London) *18*, 369-70 (Nov. 1953). Photographs and descriptions of automobiles produced from glass fiber reinforced plastics and shown at the Motor Show in London are presented.

PLASTICS EXTRUSIONS GROW. R. Marx. Materials & Methods *39*, 100-01 (Jan. 1954). Thermoplastics extrusions often offer economical solutions to knotty design problems. Seven brief case histories of recent applications of extrusions are given.

Materials

LIQUID POLYACRYLATES. F. Leonard, A. J. Szlachtun, and I. Cort. J. Polymer Sci. *11*, 539-44 (Dec. 1953). Liquid polymers of ethyl, *n*-butyl, and 2-ethylhexyl acrylates were prepared using an anionic initiating system. Liquid polyethyl acrylate was tested as a plasticizer in a stabilized and unstabilized polyvinyl chloride plastisol composition. In the unstabilized composition, fused samples were obtained which were comparable in color to a di-2-ethylhexyl phthalate (DOP) plasticized polyvinyl chloride sample prepared under the same conditions. Stress-strain tests on stabilized films indicated that with liquid polyethyl acrylate as the plasticizer a film was obtained showing higher tensile strength, yet equivalent ultimate elongation as compared to a similarly prepared DOP plasticized composition.

PREPARATION, PROPERTIES, AND STRUCTURE OF POLYHYDROCARBONS DERIVED FROM *p*-XYLENE AND RELATED COMPOUNDS. M. H. Kaufman, H. F. Mark, and R. B. Mesrobian. J. Polymer Sci. *13*, 3-20 (Feb. 1954). A pyrolytic dehydrogenation technique originally proposed by Szwarc was employed for the preparation of polyhydrocarbons from *p*-xylene, pseudocumene, and durene. With particular emphasis on poly-*p*-xylylene, the structure and physical properties of the polymers were investigated. Poly-*p*-xylylene may be obtained in two modifications: a transparent form and an opaque form. The transparent form exhibits uniaxial, negative bi-refringence. The opaque form on purification by chloroform extraction melts at 412° C. Heat treatment of either modification appears to result in an irreversible, polymorphic transition.

Molding and Fabricating

SILVERING OF PLASTICS. K. S. Low. Brit. Plastics *26*, 457-60 (Dec. 1953). A process is described for applying a metallic coating to plastic surfaces by spraying with a silver solution. The process involves essentially cleaning the plastic surface, application of an under-coat of thermosetting resin, followed by spraying with a sensitizing solution and then the silver solution, and finally the application of a top-coat of lacquer. This method is very rapid and involves little initial cost.

LARGE PLASTIC MOLDINGS. J. B. Campbell. Materials & Methods *38*, 91-95 (Dec. 1953). New, improved resins and better production techniques and equipment underlie the trend to larger thermosetting moldings. The advantages and limitations of large plastic moldings, the materials generally used, molding procedure, mold and piece design, and production and costs are discussed. A list of 22 design pointers is given, and a graph of the range of physical properties for various resin-filler combinations is also included.

NEW DEVELOPMENTS IN LIQUID HEATING OF PLASTICS PROCESSING MACHINERY. P. L. Geiringer and F. Hasselriis. Mech. Eng. *75*, 957-62 (Dec. 1953). The new developments in liquid heating and cooling of plastics machinery are reviewed and the superior ability of liquid heat carriers to meet the increasingly stringent requirements of the industry are explained. Liquid heat carriers, as opposed to vapor or electrical heaters, offer uniform temperatures over a large area, wide temperature range usage, accurate temperature control with quick response, and control of several temperature zones with one heating and cooling unit. Typical applications of liquid heating are given in calendering, extruding, molding, and pressing equipment.

MATERIALS FOR EXTRUSION. Plastics (London) *18*, 418-25 (Dec. 1953). Special techniques required for extruding the following types of plastics are discussed: polyvinyl chloride, cellulose acetate, polyethylene, polytetrafluoroethylene, polytrifluoromonochloroethylene, casein, nylon, polystyrene, phenolics, and cellulose acetate butyrate. A table of important properties of various commercially available compounds is presented.

Applications

SILICONES IN PACKAGING. D. M. Francino. Modern Packaging *27*, 149-53 (Nov. 1953). The unique properties of silicones have led to many diverse applications of these materials in packaging. Paper treated with silicones is used as water-repellent wrapping paper. Silicone-treated parchment can be used as liners for baking pans, and silicone-treated bottles prevent adhesion to the sides by both liquids and powders. Silicone rubber stoppers can be sterilized without sticking together. A new group of

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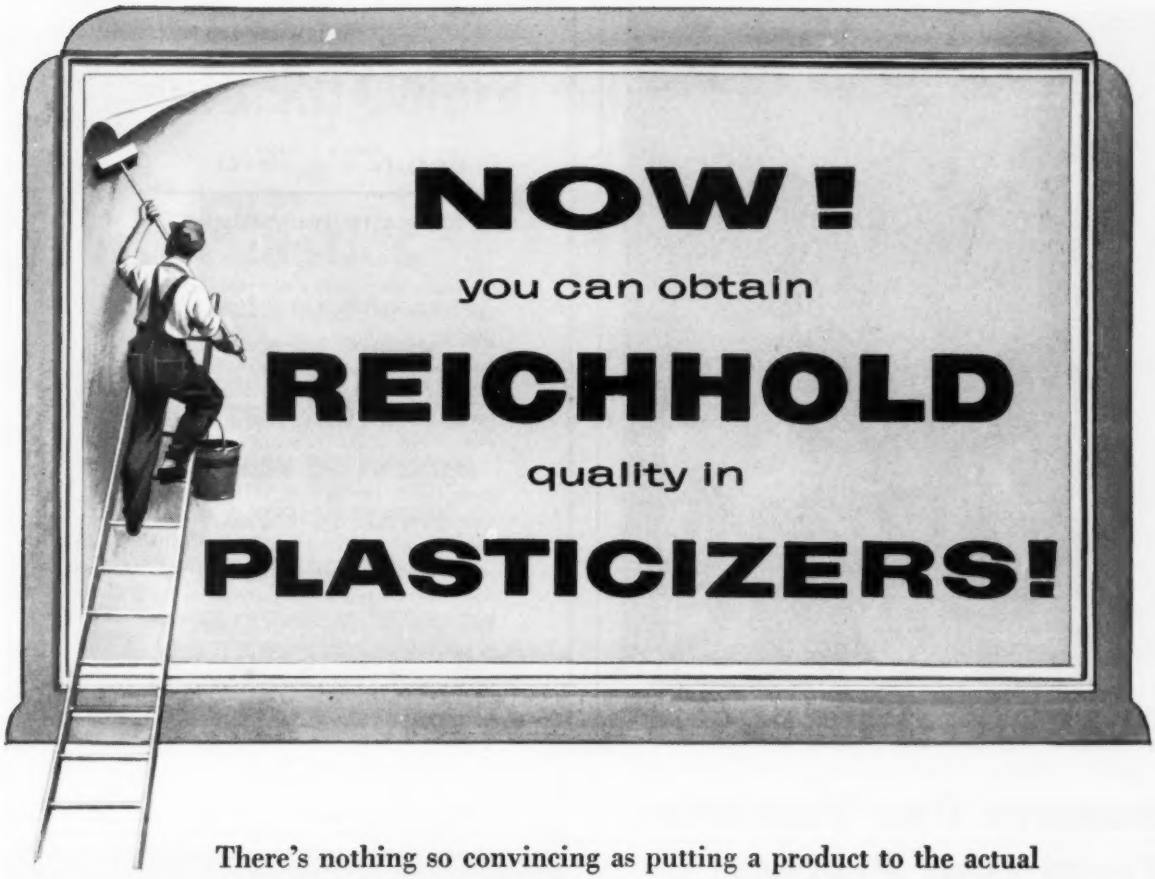

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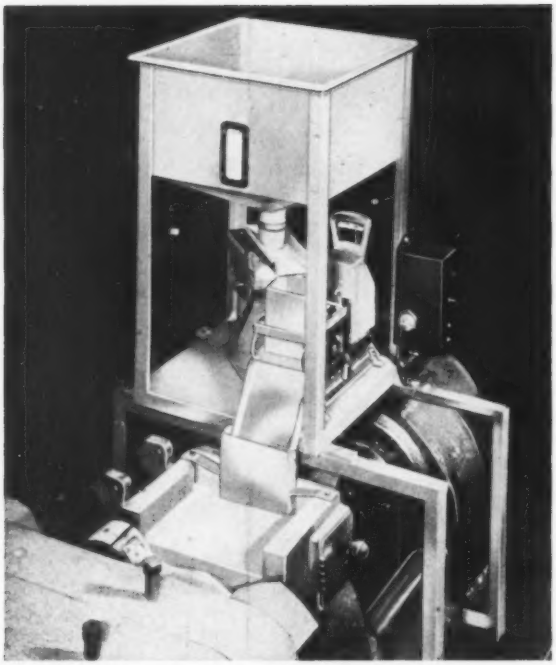

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silicones have excellent adhesive properties over a wide range of temperatures and are being used for pressure-sensitive tapes. The anti-foaming properties of silicones are utilized in bottle-filling machines. These applications represent only the beginning of development work.

MOLDED PLASTICS FIND A PLACE. Modern Packaging *27*, 89-95, 188, 191 (Dec. 1953). Molded plastic packages are finding increasing acceptance for a wide range of products. This increased use is due to improved, lower-cost plastic materials, higher-capacity molding equipment, and a more complete knowledge of design possibilities. Polystyrene, cellulose acetate, and polyethylene dominate the field of molded plastic packaging.

POLYETHYLENE CARBOYS. J. H. Parliman. Modern Packaging *27*, 133-38 (Jan. 1954). Physical and chemical properties of blow-molded, one-piece polyethylene carboys are discussed. Estimated permeability values for a number of common chemicals are given, along with chemical resistance data. Chemicals that can be shipped in polyethylene carboys are listed, as well as those which should not be shipped in these containers. The development of the ICC specifications under which blow-molded polyethylene containers are made is discussed as well as the regulations affecting chemicals shipped in such containers.

Properties

PHYSICAL PROPERTIES OF POLYETHYLENE TEREPHTHALATE FILMS. L. E. Amborski and D. W. Flierl. Ind. Eng. Chem. *45*, 2290-95 (Oct. 1953). Polyethylene terephthalate, the condensation polymer made from terephthalic acid and ethylene glycol, is available in both fiber and film forms, the former known as Dacron polyester fiber and the latter as Mylar polyester film. Mylar, produced in various gages from 0.25 to 7.5 mils has a melting point of about 255° C. and a density of 1.38. It is tough and durable over a wide range of temperatures (−60 to 200° C.). Because, even upon immersion, it absorbs less than 0.5% water, the physical properties of Mylar are essentially the same wet and dry. This film is insoluble in most common organic solvents even at boiling temperature, but it is soluble in some polar solvents like phenol. It resists the action of mineral acids even at the boiling point. In strong basic solutions it is somewhat susceptible to hydrolysis. Mylar is unaffected by many electrical varnishes and impregnants at elevated temperatures. The electrical characteristics of Mylar polyester film indicate it to be a superior dielectric. It has a high dielectric strength and high resistivity even at elevated temperatures. Mylar polyester film is a good barrier to the passage of water vapor, organic solvent vapors, odors, oils, and grease.

THERMAL DEGRADATION OF TETRAFLUOROETHYLENE AND HYDROFLUOROETHYLENE POLYMERS IN A VACUUM. S. L. Madorsky, V. E. Hart, S. Straus, and V. A. Sedlak. J. Research Nat. Bur. Standards *51*, 327-33 (Dec. 1953). Teflon and tetrafluoroethylene photopolymers, on pyrolysis in a vacuum at 423.5 to 513.0° C., yield almost 100% of monomer. The rate of formation of monomer at any given temperature follows a first-order reaction and is independent of the method of

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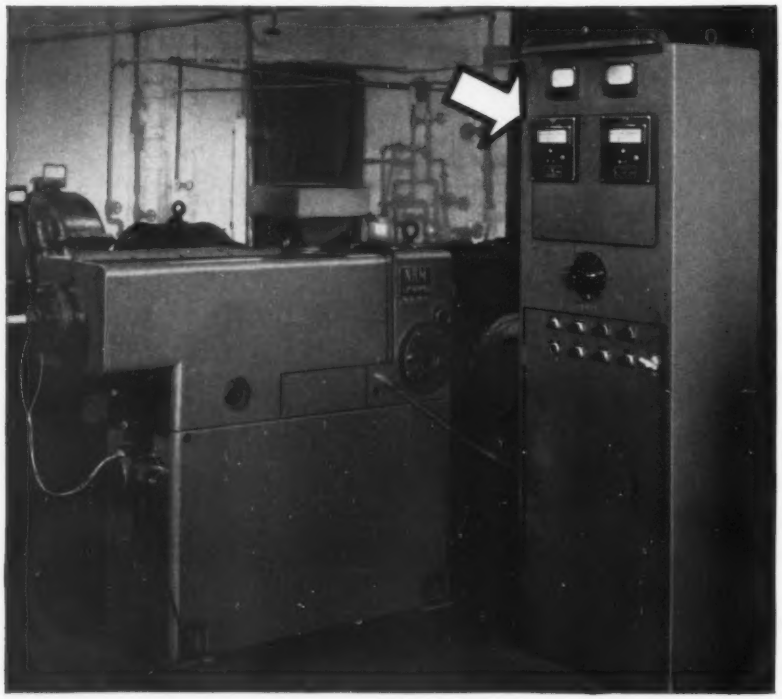

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preparation of polymer or its initial average molecular weight. The activation energy was determined by a pressure method and a weight method, and a value of 80.5 kcal. was found by both methods. A preliminary heating of Teflon in air at 400 to 470° C. did not change appreciably its rate of degradation into monomer when it was subsequently heated in a vacuum. Polyvinyl fluoride, 1,1-polyvinylidene fluoride, and polytrifluorethylene were pyrolyzed in the range 372 to 500° C. The volatiles consisted in all cases of HF and a wax-like material consisting of chain fragments of low volatility. Polyvinyl fluoride and polytrifluoroethylene degrade to complete volatilization, whereas 1,1-polyvinylidene fluoride becomes stabilized at about 70% loss of weight. The rate-of-volatilization curves indicate a first-order reaction for polyvinyl fluoride, a zero-order reaction for trifluoroethylene, and an undetermined order for 1,1-polyvinylidene fluoride. The order of thermal stability for these polymers, as compared with polymethylene, is as follows: Polyvinyl fluoride <polymethylene <polytrifluoroethylene <1,1-polyvinylidene fluoride <polytetrafluoroethylene.

SWELLING PROPERTIES OF POLYSTYRENE CROSSLINKED BY HIGH-ENERGY RADIATION. A. Charlesby. J. Polymer Sci. *11*, 521-29 (Dec. 1953). Polystyrene has been crosslinked by atomic pile radiation, the degree of crosslinking being proportional to the radiation dose. The swelling properties of the crosslinked polymer have been studied as a function of degree of crosslinking. A relationship of the form required by theory is found. However, this formula fails at low degrees of crosslinking. A fuller investigation shows that a number of corrections must be applied, taking into account gel fraction, distribution of molecular weight, and crosslinking index in the gel, etc. On the assumption that the initial molecular weight follows a Poisson distribution, good agreement is obtained between the fuller theory and observed data. The number-average molecular weight is between 1.53×10^5 and 2.14×10^5. The relationship between degree of crosslinking and radiation dose is also obtained, and is identical with that deduced previously by entirely

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EFFECT OF CHAIN BRANCHING AND MOLECULAR WEIGHT ON PHYSICAL PROPERTIES OF POLYETHYLENE. C. A. Sperati, W. A. Franta, and H. W. Starkweather, Jr. J. Am. Chem. Soc. 75, 6127-33 (Dec. 20, 1953). Various properties of polyethylene resins are controlled by combinations of the independent structural parameters of short chain branching, long chain branching, and molecular weight. Stiffness, yield point, melting point, and sorption of reagents are controlled primarily by crystallinity as affected by short chain branching and measured by density. Ultimate elongation, Vicat temperature, and hardness are controlled by both density and melt viscosity (measuring molecular weight). Finally, the viscoelastic properties of the molten polymer and the ultimate strength of the solid are controlled by molecular weight and the amount of long chain branching. Equations representing the relationship between these variables are presented, and an explanation is given for apparent anomalies.

Testing

A NEW IMPACT MACHINE FOR PLASTICS AND INSULATING MATERIALS. R. Burns. ASTM Bulletin No. 195, 61-62 (Jan. 1954). The pendulum type excess energy impact machine (Izod) has been used since the 1920's for engineering evaluation and commercial application of plastics and electrical insulation materials. As a national standard it plays an important part in civilian and military procurement. A recognized source of error in testing low-strength plastics and electrical insulating materials of different densities by the Izod method is the toss factor, that is, that part of the pendulum energy consumed in tossing away the broken half of the test specimen. A machine has been designed which is similar to the Izod but utilizes the principle that if the specimen is in motion it will contain the kinetic energy to toss itself and such energy will not appear as an error in the impact strength reading.

DETERMINATION OF TOTAL AND PRIMARY HYDROXYL IN CELLULOSE ESTERS BY ULTRAVIOLET ABSORPTION METHODS. C. J. Malm, L. J. Tanghe, B. C. Laird, and G. D. Smith. Anal. Chem. *26*, 188-90 (Jan. 1954). Different amounts of primary and secondary hydroxyl groups are formed during the hydrolysis of cellulose acetate, depending on the exact conditions of hydrolysis. As the properties of the hydrolyzed cellulose ester depend on the relative amounts of the different hydroxyls, this information is desirable for characterizing the ester. Ultraviolet absorption measurements have been used to measure quantitatively the amounts of carbanilate and of trityl introduced into hydrolyzed cellulose acetate by reaction with phenyl isocyanate and trityl chloride, respectively. Measurement of the carbanilate content allows calculation of the total hydroxyl, and measurement of the trityl content allows calculations of the primary hydroxyl in the original material. These methods have been applied to a wide variety of cellulose esters.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 25¢ each.

POLYMERS. R. C. Morris and G. W. Conklin (to Shell). U. S. 2,664,414, Dec. 29. Polymers of unsaturated thioethers.

POLYMERIZATION. H. F. Park (to Monsanto). U. S. 2,664,416, Dec. 29. Polymerization of vinyl halide with a cyclic catalyst.

BONDING. J. M. Torr (to Phillips Screw). U. S. 2,664,938, Jan. 5. Machine for bonding plastics.

RESIN. J. K. Simons (to Allied Chemical). U. S. 2,665,260, Jan. 5. Ketodiguanamine-formaldehyde resins.

MOLDED PRODUCTS. T. C. Baker (to Allied Chemical). U. S. 2,665,261, Jan. 5. High-impact molding compositions.

COATINGS. C. J. Rolle and W. Van Kirk (to Interchemical). U. S. 2,665,262, Jan. 5. Vinyl chloride-acetate coatings.

POLYESTERS. A. M. Howald (to Allied Chemical). U. S. 2,665,263, Jan. 5. Polyester compositions.

LIGHT STABILIZERS. A. R. Burgess (to Imperial Chemical). U. S. 2,665,265, Jan. 5. Metal chelate stabilizers.

RESINS. D. Wasserman (to Harvel). U. S. 2,665,266, Jan. 5. Glycidyl ethers of phenolic resins.

COPOLYMERS. J. M. Wilkinson, Jr. and J. P. Barker (to General Aniline). U. S. 2,665,267, Jan. 5. Copolymers of 1-acyloxy-3-buten-2-one.

POLYMERIZATION. W. B. Reynolds, J. E. Wicklatz, and T. J. Kennedy (to Phillips Petroleum). U. S. 2,665,269, Jan. 5. Emulsion polymerization of vinylidene compounds.

COPOLYMERS. R. N. Haward and J. Elly (to Petrocarbon). U. S. 2,665,270, Jan. 5. Copolymers of styrene and divinylbenzene.

POLYMERIZATION. H. Beller (to General Aniline). U. S. 2,665,271, Jan. 5. Polymerization of N-vinyl lactams.

POLYMERIZATION. W. B. Reynolds, J. E. Wicklatz, and T. J. Kennedy (to Phillips Petroleum). U. S. 2,665,272, Jan. 5. Emulsion polymerization at low temperatures.

COPOLYMERS. D. J. Carlick (to Interchemical). U. S. 2,665,283-4, Jan. 5. Copolymers of styrene with pentadiene and isoprene.

POLYSTYRENE. J. O. Beattie (to Cast Optics). U.S. 2,665,452, Jan. 12. Transparent polystyrene sheets.

PANELS. G. Steffenino. U.S. 2,665,735, Jan. 12. Continuous production of hollow panels from resin-impregnated web material.

SEAMING. V. H. Hasselquist (to B. F. Goodrich). U.S. 2,665,737, Jan. 12. Apparatus for seaming plastic sheet.

SEALING. N. H. Caskin (to B. F. Goodrich). U.S. 2,665,738, Jan. 12. Heat-sealing apparatus.

HOLLOW BODIES. C. V. Carlson and W. E. Schober (to Cosom Industries). U.S. 2,665,739, Jan. 12. Manufacturing hollow bodies from thermoplastic shells.

POLYMERIZATION. K. Nozaki (to Shell). U.S. 2,666,025, Jan. 12. Polymerization by irradiation.

FOAM. E. H. Schwencke (to Elastomer Chemical). U.S. 2,666,036, Jan. 12. Cellular vinyl ester resin.

RESINS. A. P. Ingrassia (to Masonite). U.S. 2,666,037, Jan. 12. Reducing-sugar-modified aniline-phenol-formaldehyde resin.

RESINS. R. J. Reid and W. M. Smith, Jr. (to Firestone). U.S. 2,666,039-40. Jan. 12. Stabilizing and plasticizing vinylidene chloride resins.

COPOLYMERS. K. Nozaki (to Shell). U.S. 2,666,042, Jan. 12. Segmented copolymers.

COPOLYMERS. W. E. Catlin (to Du Pont). U.S. 2,666,044, Jan. 12. Acrylic copolymers.

COPOLYMERS. F. C. Foster (to Firestone). U.S. 2,666,045, Jan. 12. Copolymers of styrene and chloroprene.

COPOLYMERS. J. F. Nelson, R. F. Leary, and L. M. Welch (to Standard Oil). U.S. 2,666,046, Jan. 12. Olefin-aromatic unsaturated compound copolymers.

POLYMERIZATION. G. J. Koch, Jr. (to Diamond Alkali). U.S. 2,666,047, Jan. 12. Chromate-sulfite redox-initiated polymerization of vinyl chloride.

MOLDING. W. J. Strong and R. E. Lindemann (to B. F. Goodrich). U.S. 2,666,228, Jan. 19. Apparatus for stripping molded articles from molds.

MOLDING. C. W. Vogt. U.S. 2,666,229, Jan. 19. Method and apparatus for measuring plastic masses.

MOLDING. R. J. Sherman. U.S. 2,666,230, Jan. 19. Molding apparatus.

MOLDING. C. W. Vogt. U.S. 2,666,400, Jan. 19. Feed supply for molding machines.

MOLD RELEASE. M. C. Hommel and C. C. Currie (to Dow Corning). U.S. 2,666,685, Jan. 19. Silicone mold release.

PLASTIC TREATMENT. Z. Meretey (to P. M. Industries). U.S. 2,666,693-4, Jan. 19. Acid etching a filled plastic to expose filler on the surface.

COATING. K. J. Lissant (to Petrolite). U.S. 2,666,719, Jan. 19. Furfural-furfuryl alcohol coating.

POLYMERS. J. B. Dickey and H. W. Coover, Jr. (to Eastman Kodak). U.S. 2,666,750, Jan. 19. Polymeric phosphonic acid diamides.

STABILIZER. O. J. Grummitt, R. E. Blank and H. F. Schwartz (to Sherwin-Williams). U.S. 2,666,752, Jan. 19. Stabilizer for halogen-containing polymers.

STABILIZERS. R. L. Zapp (to Standard Oil). U.S. 2,666,753, Jan. 19. Stabilization of vulcanized isobutylene copolymers.

SILICON POLYMERS. D. S. Sears (to B. F. Goodrich). U.S. 2,666,754, Jan. 19. Reaction product of silicon monoxide, ammonia, and rubber.

CATALYSIS. T. Boyd and R. M. Dickey (to Monsanto). U.S. 2,666,756, Jan. 19. Catalysis of ethylene

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polymerization with hydrogenation catalyst.

TITANIUM POLYMERS. T. Boyd (to Monsanto). U.S. 2,666,772, Jan. 19. Polymeric titanium ester anhydrides.

SHEET DRAWING. L. C. Grove and R. L. Thompson (to U. S. Rubber). U.S. 2,666,951, Jan. 26. Apparatus for drawing plastic sheets.

BRISTLES. F. J. G. Olmer and G. A. Nesty (to Allied Chemical). U.S. 2,666,976, Jan. 26. Acrylonitrile copolymer bristles.

TRACTOR CAB. G. P. Baze. U.S. 2,667,379, Jan. 26. Plastic tractor cab.

IMPREGNATED FABRIC. J. R. Wells (to U. S. Rubber). U.S. 2,667,430, Jan. 26. Resin-impregnated glass fabric.

POLYETHYLENE. C. M. Zoubek (to Swift). U.S. 2,667,437, Jan. 26 Sealing polyethylene films.

ADHESIVE. M. F. Wildish, J. E. Hefferline, and H. F. Rippey (to Monsanto). U.S. 2,667,462. Jan. 26. Adhesive from monoethylenically unsaturated dilcarboxylic acid salt polymer.

POLYMER. R. H. Jakob, R. W. H. Tess, and T. F. Bradley (to Shell). U.S. 2,667,463, Jan. 26. Interpolymer of cyclo-diolefin and an unsaturated ester.

INSULATION. M. S. Greenhalgh (to General Electric). U.S. 2,667,464, Jan. 26. Vinyl halide insulation compositions.

MOLDING. R. J. Nebesar (to Universal Moulded Products). U.S. 2,667,465, Jan. 26. Reaction products of polyester resin with vinyl acetate, vinyl chloride, or amyl acrylate.

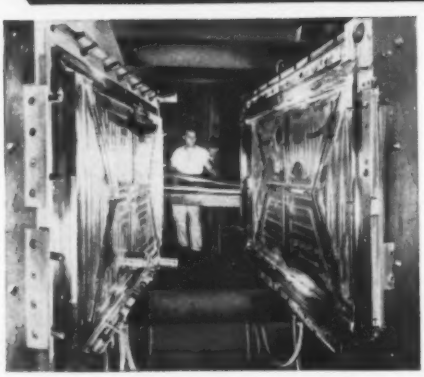
RESIN. D. E. Nagy (to American Cyanamid). U.S. 2,667,466, Jan. 26. Phenolic resin-borax condensate.

COPOLYMERS. R. R. Morner (to Monsanto). U.S. 2,667.467, Jan. 26. Styrene copolymers.

POLYSULFONAMIDES. W. D. Jones and S. B. McFarlane (to Celanese). U.S. 2,667,468, Jan. 26. Polysulfonamides.

VINYL ESTERS. J. C. Sauer (to Du Pont). U.S. 2,667,469, Jan. 26. Vinyl

PLASTIC MOLDS



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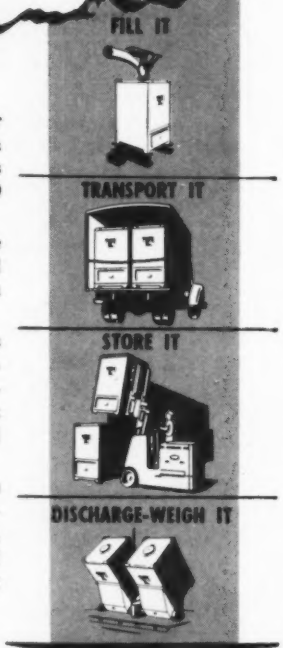

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Beatrice, Nebraska

esters of hydrocarbon sulfonic acids and polymers thereof.

COPOLYMERS. R. R. Morner and R. I. Longley, Jr. (to Monsanto). U.S. 2,667,473, Jan. 26. Vinyl acetate N-vinyl pyrrolidone copolymers.

HEAT TREATMENT. W. T. Miller (to U. S.). U.S. 2,667,474, Jan. 26. Heat treatment of polytrifluorochloroethylene plastic articles.

POLYMERIZATION. E. C. Herrick and J. C. Sauer (to Du Pont). U.S. 2,667,520, Jan. 26. Polymerization of acetylene.

SHUTTLECOCKS. W. C. Carlton. U.S. 2,667,662, Feb. 2. Plastic shuttlecocks.

CELLULOSE DERIVATIVES. W. A. Reeves and J. D. Guthrie (to U. S.). U.S. 2,668,096, Feb. 2, Aminoethylated cellulose derivatives.

PLASTICIZER. W. B. Horback, F. Berardinelli, and W. D. Paist (to Celanese). U.S. 2,668,119, Feb. 2. Monopropyl dixylyl phosphate.

FILM. C. W. Leaf and L. M. Liggett (to Wyandotte). U.S. 2,668,120, Feb. 2. Carboxymethyl cellulose films.

POLYETHYLENE. P. V. Horton (to Plax). U.S. 2,668,134, Feb. 2. Surface treating polyethylene with sulfuric acid and sodium dichromate.

SPONGE. G. M. O'Neal (to Sherwin-Williams). U.S. 2,668,152, Feb. 2. Cellular plastics.

SPONGE. H. G. Hammon (to C. L. Wilson). U.S. 2,668,153, Feb. 2. Polyvinyl alcohol sponge.

ADHESIVES. G. O. Orth, Jr. (to Mathieson). U.S. 2,668,154, Feb. 2. Protein adhesives from animal glue, a hydrazide, and formaldehyde.

CONDENSATES. W. R. McClellan (to Du Pont). U.S. 2,668,155, Feb. 2. Urea-formaldehyde alkylene-diamine condensates.

STARCH DERIVATIVES. C. G. Caldwell and O. B. Wurzburg (to National Starch Products). U.S. 2,668,156, Feb. 2. Unsaturated starch derivatives.

ENAMELS. F. J. Emig and M. J. Moth (to Du Pont). U.S. 2,668,157, Feb. 2. Plastic wire enamels.

COATING. R. H. Sturm (to Cosmocord Plastics). U.S. 2,668,158, Feb. 2. Metal coatings containing phenolic resin and a phosphate.

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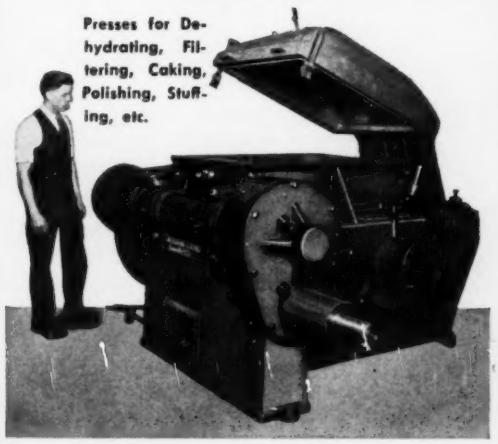

Mixers: Plain or Stainless
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NEW MACHINERY AND EQUIPMENT

Injection Machines—Model M, horizontal, all-hydraulic, 8- and 12-oz. injection molding machines have self-compensating material feeding device with controls for automatically double-stroking the injection pistons for producing shots 25 to 33⅓% above rated machine capacity. The units are manufactured by De Mattia Machine & Tool Co., Clifton, N. J., and distributed by Brosites Machine Co., Inc., 50 Church St., New York, N. Y.

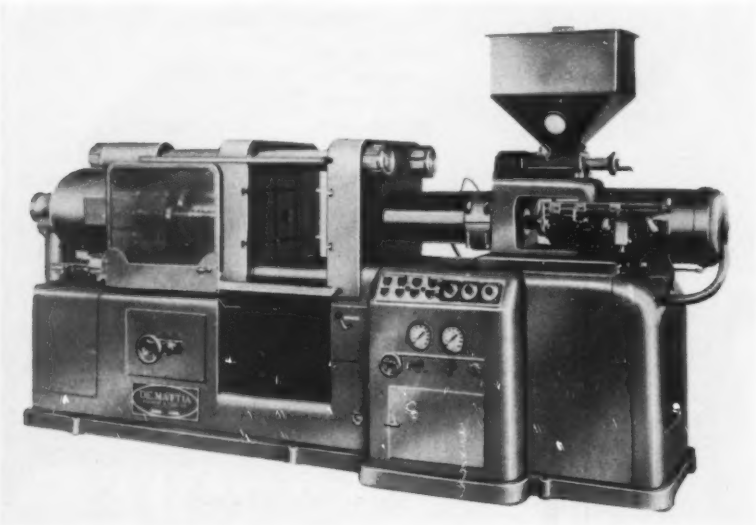
The 8-oz. machine is rated to plasticize 100 lb. of material per hr., with 6 dry-run cycles per minute. Pressure on material is 19,400 p.s.i.; mold closing pressure is 283 tons. Speed of injection plunger is 214 in./min. forward and 280 in./min. return. Size of maximum mold plates is 16 by 22 in. horizontal and 14 by 28 in. vertical. Daylight is 25 in.; mold opens 18 inches.

The 12-oz. model plasticizes 130 lb. of material per hr., with 4 dry-run cycles per minute. Pressure on material is 22,500 p.s.i. and mold closing pressure is 400 tons. Speed of injection plunger is 115 in./min. forward and 219 in./min. return. Size of maximum mold plates is 18 by 30 in. horizontal and 16 by 32 in. vertical. Daylight is 32 in.; mold opens 24 inches.

Tester—Purpose of Model L Universal Testing Machine is to determine tensile, compression, transverse, and shear strength of plastics and other materials when these materials are subjected to heat. Using different equipment, these properties can be determined for material exposed to water or cold. The instrument is offered by W. C. Dillon & Co., Inc., 14620 Keswick St., Van Nuys, Calif.

A specimen to be tested is placed in an electrically heated (or cold, or water) cabinet. The ends of the specimen are passed through narrow slits at the top and bottom of the cabinet and attached to gripping fixtures on the outside. The top fixture is connected to a dynamometer. Predetermined degrees of heat are then applied and pull is simultaneously exerted.

This tester is available in capacities from 0-250 to 0-10,000 lb., in either hand- or motor-operated models.



De Mattia's Model M injection machine can produce shots 25 to 33 1/3% above rated capacity

Heater—Designed to span large webs, far infra-red radiant heater panel measures 66 by 12 inches. The unit is produced by Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.

Radiation at its highest intensity —2.7 kw./sq. ft. for the standard model—is said to be uniformly distributed over extended areas, even at close work spacings. Output is controllable from 4 to 100% of 15-kw. capacity, with element temperature up to 1450° F. Standard voltages are 240 and 480 v.; special panels with different watt ratings and voltages up to 600 v. can be made to order.

Panel has built-in oven components, such as alloy-sheathed elements, reflector, interconnecting 100-amp. 3-phase bus, and all necessary thermal insulation. No fans or cooling systems are said to be required, since the panel is designed to operate at 700° F. on the work.

Automatic Indexer—For use with any of the company's electronic sealing presses and generators, this auxiliary machine is designed to feed, seal, index, and wind up or discharge full rolls of vinyl sheeting. The unit consists of an unwind, take-up, and control section, and is produced by Thermatron Div., Radio Receptor Corp., 251 W. 19th St., New York 11, N. Y.

In operation, two rolls of sheeting are positioned between cones on the material unwind shafts. Feed motor, feed roller, and dance roller units for each roll maintain a uniform tension on the individual sheets unwinding from the rolls. The feed motors work intermittently and are actuated by the dance rollers, which contact start and stop switches as the sheeting is fed through the machine. The sealed material coming from the press is wrap-wound around 180° of the rubber-covered lower take-up roller. A weight roller rides on the take-up roll as it rotates a specific amount, corresponding to the required index. The sealed material can be either wound up on a wind-up roll driven by the weight roller, or continuously discharged into a bin.

The machine can be used for ei-

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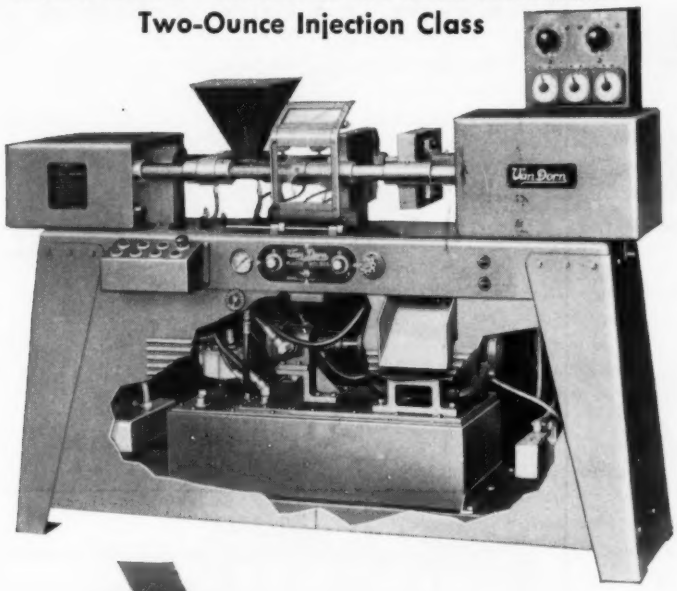
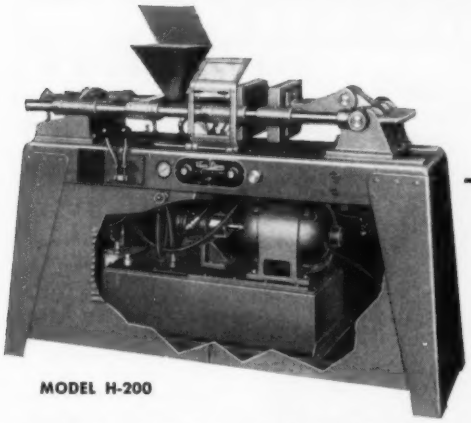


This ultra-modern press molds practically all thermoplastics including nylon. It completes up to 6 operating cycles per minute. Push button controls are safe, simple and convenient. Compact and rugged, the unit is quiet and economical in operation. Sliding gate with interlocking safety devices starts the cycle. Solenoid valves close the molds. Injection and dwell are controlled by first of three timers on the rear panel. Center timer regulates recharging of heater. The third timer controls the length of the mold close cycle; when time runs out, molds automatically open and parts are ejected. Operator opens safety gate, removes product and then closes gate to begin the next cycle . . . Variable voltage transformers in conjunction with thermostatic units control the temperatures on the two heating zones accurately.



MODEL H-200

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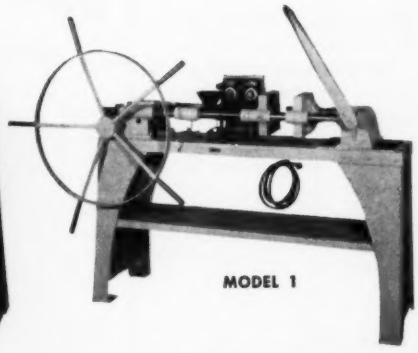
2-oz. or 1-oz. capacity. These low-cost units operate 8 hours for under a dollar and use inexpensive molds. Can easily be set up in twenty minutes by one man.



MODEL 1

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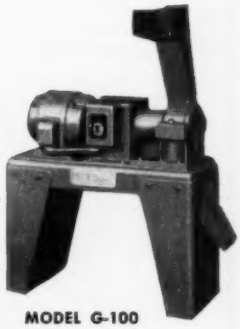

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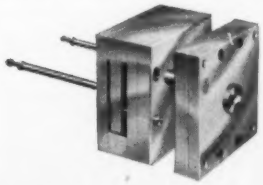

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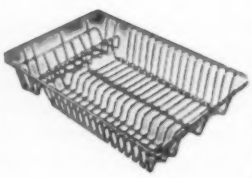

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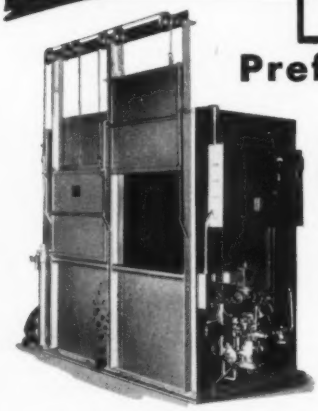

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Molders of Plastics for over a Quarter Century

ther manual or automatic operation. Length of index is 6 to 24 in., with $\pm\frac{1}{32}$-in. accuracy of index and side registry. One or two rolls of sheet can be processed, ranging in width from 6 to 24 in., and from 0.008 to 0.020 in. in thickness.

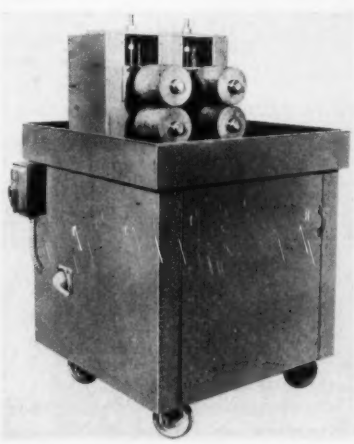
Engraving Machine—Model 3D-5, a three-dimensional engraving unit for use with plastics, steel, wood, and other materials, has a range of ratios from 1.7:1 to 7:1. The unit was engineered by H. P. Preis Engraving Machine Co., 192 Industrial Branch, Hillside, N. J. It can also engrave enlargements in the reverse of the ratios mentioned by the simply executed operation of switching spindle and tracing stylus.

Over-all size is 23 in. long, 48 in. wide, and 19 in. high, and spindle speeds of 5000, 7000, 9000, and 12,000 r.p.m. are available to the operator. The unit is furnished complete with a 1725-r.p.m. motor and all standard accessories, including work table, clamps, copy holder, spindle, collet, belts, pulley, cutters, grease gun, and wrenches.

Extrusion Accessories—Four-roll capstan, developed by Robbins Tool & Die Co., is powered by a U. S. Varidrive motor through a jack shaft for greater speed range. The rolls are adjustable and are said to be capable of handling material up to 2 in. thick. The unit incorporates a splash pan for clean operation.

Robbins Tool has also introduced a refrigerator water tank, which

Robbins Tool's capstan is equipped with rolls claimed to be capable of handling material up to 2 in. thick



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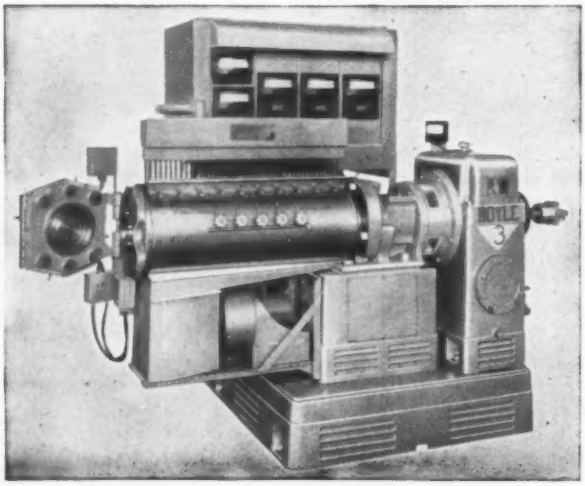

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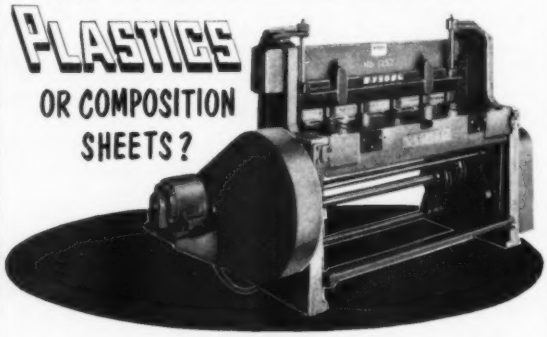

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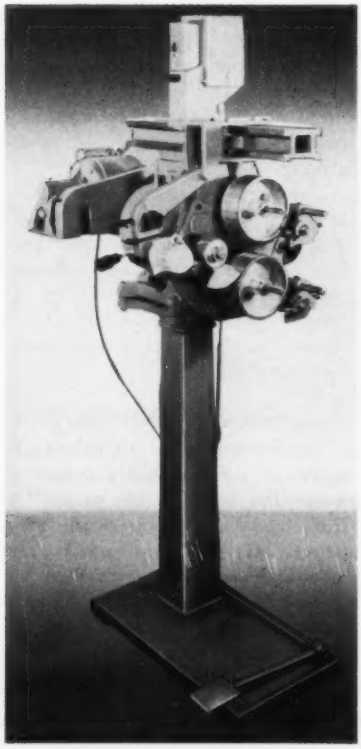
the company states will hold water at an even temperature throughout a 24-hr. period, and which is intended to provide more efficient cooling with less water usage.

Ejector Pins—Standardized ejector pins developed by Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich., for use with the shell molding process, are ⅜ in. in diameter and 6 and 7½ in. long. Their mushroom heads have a negative angle at the underside to give a positive seal and to prevent material from seeping under the head during the molding cycle. Springs used on the ejector pin assemblies will withstand molding temperatures without losing temper.

Marking Machine—Primarily developed for the plastics field, Series 67A marking machines, manufactured by Markem Machine Co., Keene, N. H., can imprint cylindrical or semi-formed shapes (tumblers, bottles, etc.), slightly curved items (such as cereal dishes), and products with pronounced curvature

Markem's Model 67A is especially suited for the imprinting of cylindrical, semi-formed, and curved shapes



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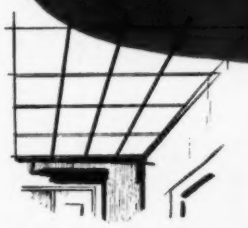

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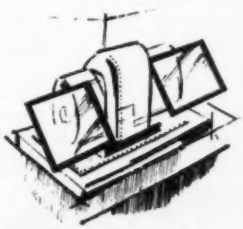

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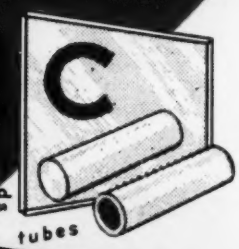

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(cups, sugar bowls, creamers, etc.) with either one or two colors.

The equipment operates on the offset principle and can accommodate items of up to 4-in. diameter when banding completely around the object. Area of imprint can be as high as 4 in., depending on contours of the article. Registration is said to be excellent.

Injection Machine—Molding speeds up to 360 shots per hr. are claimed for the new Model 300T-12/16-oz. injection molding machine offered by Reed-Prentice Corp., Worcester 4, Mass. A built-in stuffing arrangement permits shots of 16 oz. or more through multiple stroke.

The heating cylinder, equipped with ceramic elements, is said to have up to 115-lb./hr. plasticizing capacity. Double shear mechanism develops 300 tons positive mechanical clamping pressure. By means of an adjustment in the link cylinder, mold clamping stroke is variable between 7½ and 12½ inches.

Mold platens measure 29 by 32½ in. and accommodate molds up to 29 by 20½ in.; rated projected area in the mold is 150 sq. inches. A central pushbutton station controls movement of die plate and plunger, mold adjustment, and heating cylinder adjustment. Feed hopper holds a standard 200-lb. material drum at a 45° angle.

The company's automatic weigh feed mechanism can be used with the Model 300T to assure accurately weighed parts and avoid overpacking.

A low-pressure die closing attachment, for fully automatic molding cycles, is available for the unit. The controlled-pressure accessory prevents damage to molds by instantly stopping the machine should a piece fail to eject automatically from the mold.

Tool Makers' Tool—A clamp that is positioned and tightened by means of a thumb screw is said to permit the hone or file of the Di-Profiler, developed by Nord International Corp., 449 Central Ave., Orange, N. J., to be rocked or rotated to conform with the contour of the die or part being worked. A regulated reciprocating stroke of from 0 to ¼ in. can be operated at speeds from 0 to 15,000 strokes per min. by foot control.

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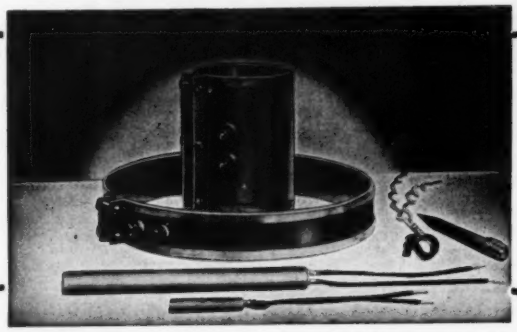

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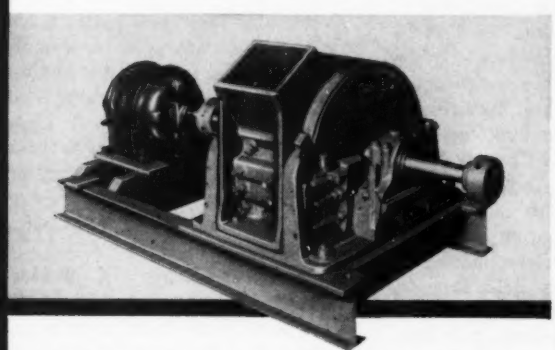

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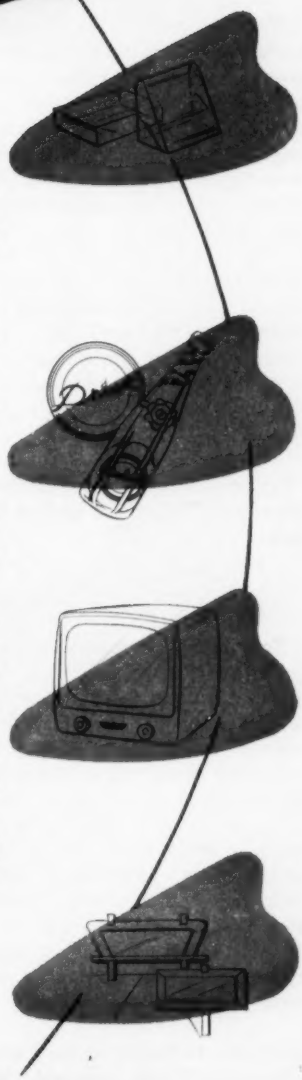

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Catalysis, Vol. I," edited by Paul H. Emmet

Published in 1954 by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. 394 pages. Price: $10.00.

The first volume in a series of books aimed at providing an integrated treatise on the physical chemistry of catalysis and catalytic processing, is devoted to catalyst supporters, carriers, and method of preparation. It covers such topics as physical adsorption, measurement of the surface area of solid catalysts, kinetic laws of surface catalysis, absolute rates of surface reactions, and others. The book is addressed to the research chemist and written on a commensurate technical level.

Future volumes will cover specific applications of the catalytic process in detail.

"Tables of Circular and Hyperbolic Sines and Cosines for Radian Arguments"

Published in 1953 by Government Printing Office, Washington 25, D. C. (NBS Applied Mathematics Series 36). 407 pages. Price: $3.00 (foreign $4.00).

To meet the continuing demand from scientists and engineers, the government has reissued these tables of circular and hyperbolic sines and cosines. The interval of the argument and the use of radian measure should prove of particular convenience to the user. Specifically, these tables contain sin x, cos x, sinh x and cosh x, $x = 0\ (0.0001)\ 1.9999$, 9D; sinh x and cosh x, $x = 0\ (0.1)\ 10$, 9D; sinh x and cosh x, $x = 0\ (0.1)\ 10$, 9D; a conversion table of degrees, minutes, seconds $\leftrightarrows$ radians, and a table of multiples of $\pi/2$.

"A Guide to Safety in the Chemical Laboratory," by General Safety Committee of the Manufacturing Chemists' Association, Inc.

Published in 1954 by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. 160 pages. Price: $4.25.

This manual sets forth a basis for guiding laboratory personnel, students, and teachers in good safety practices in the handling of laboratory chemicals, equipment, and processes. It contains chapters on laboratory design and equipment, handling of glassware, handling and storage of containers, flammability and miscellaneous hazards, chemical hazards, toxicity, radiation safety and contamination control, pressure vessel hazards, clothing and personal protective equipment, packaging and transportation of chemicals, and first aid.

"Induction and Dielectric Heating," by J. Wesley Cable

Published in 1954 by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. 576 pages. Price $12.50.

High-frequency heating is a major process in many plastics forming and fabrication operations; a well-organized treatment of the theory, uses, and applications of this heating method will therefore be welcomed by the industry. The present volume is such a treatment. Divided into two sections, the volume presents the fundamental theory of high-frequency magnetic and dielectric fields, the operating principles of equipment used as sources of electric energy, coil and electrode design, and information on the construction of mechanical jigs and fixtures, as well as on work handling methods. Of special interest is Chapter XVII, "Dielectric Heating in the Plastics Industry," where the author discusses dielectric heating as applicable to various production processes in the plastics field.

"Materials and Processes, 2nd Edition," by James F. Young

Published in 1954 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1074 pages. Price: $8.50.

The object of this up-to-date survey of current engineering materials and manufacturing processes, presented from the viewpoint of the engineer, is to encompass in one volume all the interrelated information required to apply the engineering fundamentals of materials and processes to the design, production, and control of products. Advances which have taken place over the ten years since the first edition of this volume was published have been incorporated in the present discussion. Separate chapters and sections on plastics materials and processing equipment and machinery are included.

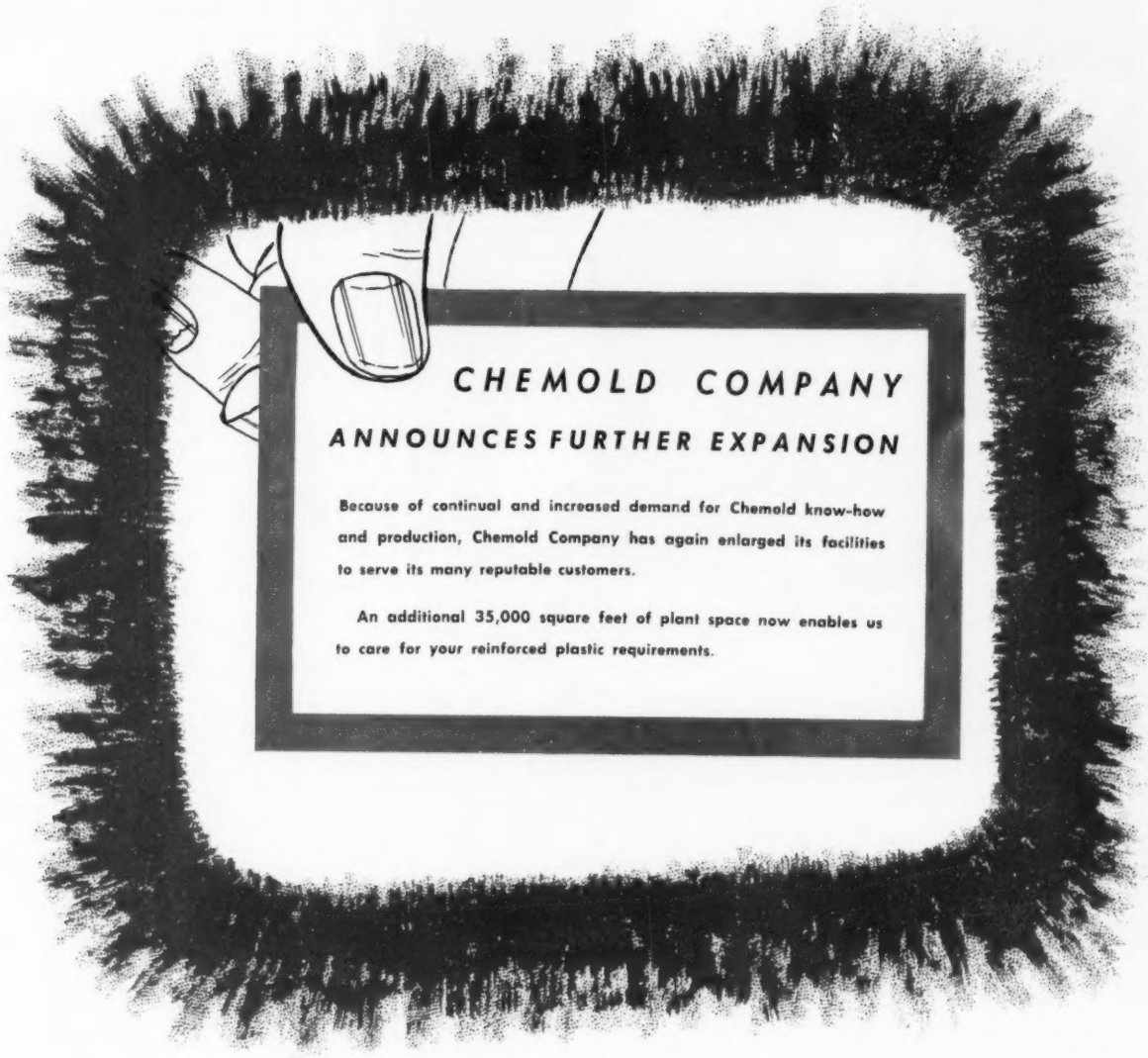
"Pioneers of Progress"

Published in 1953 by Putman Publishing Co., 111 E. Delaware Pl., Chicago, Ill. 52 pages. Price: $5.00.

This panegyric to the plastics industry sets out to honor the men and companies that have been responsible for outstanding achievement in the field of the chemical sciences and industry. In the first part it presents photographs of the members of various company "teams"; in the second it relates "epics of action," the stories of some of the major accomplishments of these companies. Those who come in for their share of encomiums include: Carbide and Carbon Chemicals Co. (Coal Hydrogenation), Monsanto Chemical Co. (Krilium), E. I. du Pont de Nemours & Co. (Functional Synthetic Fibers), Charles Pfizer and Co. (Miracles From Molds), Dow Corning Corp. (Silicones), Shell Chemical Co. (Synthetic Glycerine), Owens-Corning Fiberglas Corp. (A New Concept in Glass), and American Cyanamid Co. (Melamine).

Plastics finishing—Various methods of finishing and polishing molded plastics articles are discussed in this 9-page booklet. Some of the methods investigated are de-flashing with wire barrels, de-flashing with closed metal barrels, finishing with granules or balls, barrel polishing, and mop polishing. *Lacrinoid Products Ltd., Gidea Park, Essex, England.*

Glass fibers—Range of products made by the company of fibrous glass, and the method it uses in producing glass fibers are discussed in this 6-page folder. The products include reinforcing mat, surfacing mat, industrial mat, tape, veils, and puffglass. The glass fibers are produced by melting glass in small furnaces and drawing it in continuous monofilaments. These monofilaments are combined in various patterns and impregnated with a variety of binders to yield the products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listed above. Individual information sheets give actual samples and information on construction, binders, treatments, dimensions, and weights. *Modigliani Glass Fibers, Inc., 55 W. 42nd St., New York 36, N. Y.*

Valves—A complete line of hydraulic valves—consisting of over 3500 models—is presented in three separate catalogs. The listing includes 2- and 4-way valves, as well as valves for relief, unloading, pressure-reducing, flow control, and other applications. Catalog 801 covers the 2000 p.s.i. oil hydraulic threaded type; catalog 821 covers the 3000 p.s.i. oil hydraulic flanged type; and catalog 841 covers the 3000 p.s.i. oil hydraulic gasket-mounted type. Sizes, engineering drawings, installation suggestions, and uses are given for each model. *The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

Plasticizers—Properties, specifications, comparative product performance, and typical formulations and application of two primary plasticizers are presented in two technical bulletins. Bulletin 0–109 covers di (n-octyl, n-decyl) phthalate (D.N.O.D.P.), Bulletin 0–106 deals with dioctyl adipate (D.O.P.). D.N.O.P. imparts low volatility and high flexibility to the finished composition; D.O.P. imparts low-temperature flexibility. *Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.*

Casting phenolic—The characteristics and physical properties of and applications for a low-viscosity, high-stability, phenolic casting resin especially compounded for use in the production of models and tools are outlined in this folder. The folder provides information on equipment, materials, patterns, molds, and cores necessary for the production of cast phenolic tools, and offers instructions for mixing, pouring, curing, post-curing, and finishing. *Wal-Mar Plastics, Inc., 21805 Western Ave., Torrance, Calif.*

Demineralizers—Mixed-bed and multi-bed demineralizers for laboratory and industrial use, ranging in capacity from 5 gal./hr. to 2500 gal./hr. are described in catalog 127. Dimensional and performance data for all models, considerations affect-

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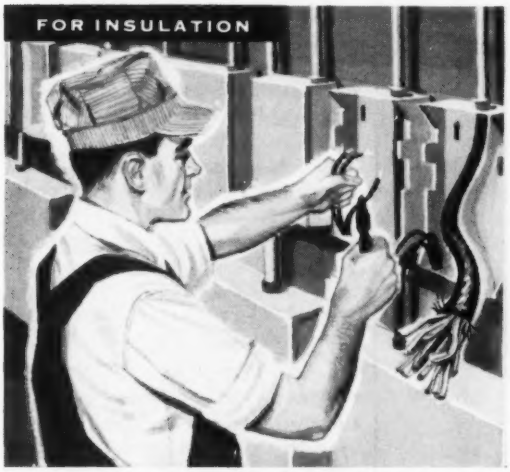

Cable wrap of special Mosinee paper winds easily, twists uniformly. Mosinee moisture resistant, extra-strong, electrical cable wrap offers a plus value. Mosinee specialized production controls insure uniformity, minimize problems in high speed twisting and cable wrap operations.

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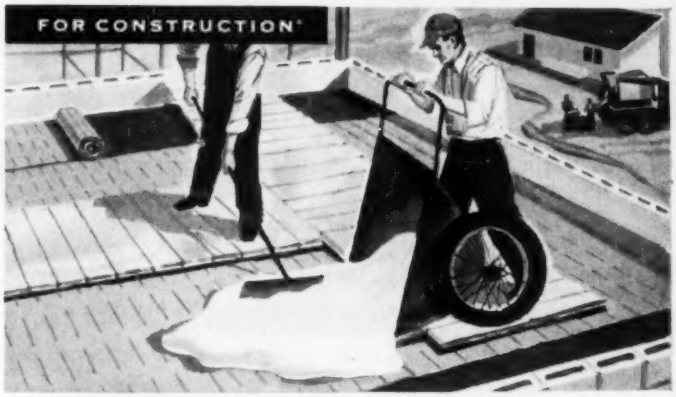

Mosinee patented reinforced paper simplifies building construction. Easy to handle Mosinee reinforced papers with steel mesh reinforcing attached, replace wood forms for pouring lightweight concrete floors. This is only one of many instances in which Mosinee cooperated in developing new papers to improve processing or production.

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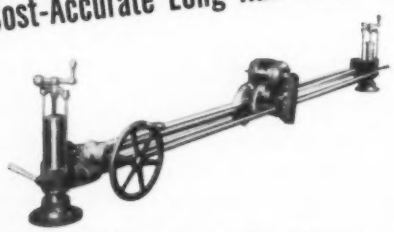
Low Cost-Accurate Long Rail Panel Saw



Cuts large sheets of plastic, plywood, and metal for all fabricating jobs. One operator activates saw across panel by handwheel on drum cable. Greatly improves accuracy and speed. Rigid rail mounts permit large sheets to be held in firm cutting position. Cut is carried downward, producing a clean finish. Saw can be tilted with rails 90° for rabbiting and mitering. Saves considerable handling — reduces all cutting costs — gives accurate cut on all large panels. Available in 6', 8', 10', and 12' long rails.

Many of these MLR long rail panel saws are in use today.

Hendrick Panel Saws will be demonstrated at the Plastics Exposition. Visit our Booth Number 555

Write for illustrated circular. Room 21

HENDRICK MFG. CORP.
Marblehead, Massachusetts

ing selection of proper equipment for a given job, and installation and operation details of the demineralizers are presented. *Barnstead Still & Sterilizer Co., 214 Lanesville Terr., Forest Hills, Boston 31, Mass.*

Fumaric acid—Technical Bulletin 0-102 lists physical and chemical properties of fumaric acid, typical reactions, and properties of fumaric acid compounds. Addition and esterification products of possible application in such fields as plastics, paints, paper coatings, organic pigments, rubber, and adhesives are also discussed. *Organic Chemicals Div., Monsanto Chemical Co., St. Louis 1, Mo.*

Furans—Properties and applications of furfural, furfuryl alcohol, tetrahydrofurfuryl alcohol, furoic acid, hydrofuramide, Furafil lignocellulose, and other furfural-derived chemicals in commercial and experimental quantities are described in 28-page Bulletin 201-A. An appendix presents engineering drawings and describes bulk handling and storage layouts for several of these materials. *Chemicals Dept., The Quaker Oats Co., Merchandise Mart, Chicago 54, Ill.*

Drapes—Advantages of using the company's polyvinyl sheet as classroom or stage draperies are outlined in this 8-page booklet. In addition, information regarding installation, colors, gages, opacities, and available embossed designs is provided. *Firestone Plastics Co., Pottstown, Pa.*

Cylinders—Series "J" hydraulic cylinders for 2000 p.s.i. oil hydraulic service, designed with rod packing cartridge, piston rod, and body said to meet all applicable J.I.C. specifications, are described in 8-page Bulletin 53. Engineering drawings for foot-mounted, flange-mounted, and swivel-mounted cylinders, as well as installation dimensions for all bore sizes are included. *Hydro-Line Mfg. Co., Rockford, Ill.*

Indian journal—First issue of "Composite Wood," a journal written in English and published in India, whose stated aim is to promote the study and practice of the science and technology of composite wood (adhesives, plywood, laminated, and other improved woods, building

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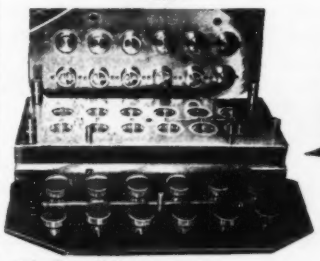

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boards, etc.) and allied subjects, contains technical articles on steaming and boiling of logs for veneer production, infra-red drying, prolamin film adhesive, and hoop pine bark. It also has departments dealing with abstracts, reviews, and news. Authors are predominantly Indian. Annual subscription rate outside of India 14 rupees (ca. $2.80). *Forest Research Institute, 15 Beeson Rd., New Forest P. O., Dehra Dun, U. P., India.*

Reinforced plastics—In spite of its title, "Manual for Building Plastic Cars" covers not only cars, but also reinforced plastics boats, furniture, home insulation, and housewares; in addition, it has a chapter on general business opportunities in the plastics field. The two sections dealing with cars give, respectively, a resume on style and performance of available cars with plastics bodies and a detailed description of the actual production process for making them. The section on boats outlines the advantages to be gained from making them with reinforced plastics hulls. Other sections describe the manufacture of reinforced plastics, building a sports car chassis, reinforced plastics racing cars, and other topics. 85¢. *Trend Books, 5959 Hollywood Blvd., Los Angeles 28, Calif.*

Vinyls—The company's line of vinyl chloride resins is detailed in this 52-page booklet. After a presentation of the history of the chemical, the booklet describes the properties of the resins for general purpose applications, and discusses compounding, processing, and forming of the resins. Detailed starting formulations, as well as a variety of applications are suggested. The booklet provides the same equivalent information for plastisols, organosols, and latices. *The Goodyear Tire & Rubber Co., Inc., Chemical Div., Akron 16, Ohio.*

Pipe—Characteristics, applications, and advantages of rigid polyvinyl pipe for use in irrigation and related fields are described and illustrated in 10-page booklet entitled "Idroresar." (In Italian) *S.P.A. La Resina, Viale Romagna N. 47., Milano, Italy.*

Heaters—Catalog GEC-1005E lists a line of electric heaters and heating devices. Included are immersion, strip, cartridge, tubular, insertion, fin, and oven heaters, as well as thermostats, melting pots, and switches. Applications, installation, and prices are given with each listing. A special section presents information on how to calculate power requirements, gives tables of heat losses under various conditions, and cites several examples on how to estimate power requirements. A process and application index correlates heater type to manufacturing operation, to facilitate finding the correct heater for a particular process. *General Electric Co., Schenectady 5, N. Y.*

Presses—Representative examples of the company's complete line of hydraulic presses and auxiliary equipment are described and illustrated in this 12-page brochure. Included are a 200-ton single-opening press for general molding and laminating operations, an 880-ton multiple opening platen press for polishing and laminating, and a 1327-ton multiple opening platen press for manufacture of molded brake linings and similar products. *R. D. Wood Co., Public Ledger Bldg., Independence Sq., Philadelphia 5, Pa.*

Sodium dispersions—The properties, preparations, and industrial applications of sodium dispersions—stable suspensions of microscopic sodium particles in inert hydrocarbon media—are contained in this 30-page booklet. Since it is desirable to mix these dispersions at point of use, rather than buy them ready-made, detailed step-by-step instructions for their preparation are listed, including necessary machinery. A section on laboratory handling procedures and a bibliography are appended. *U. S. Industrial Chemical Co., 120 Broadway, New York 5, N. Y.*

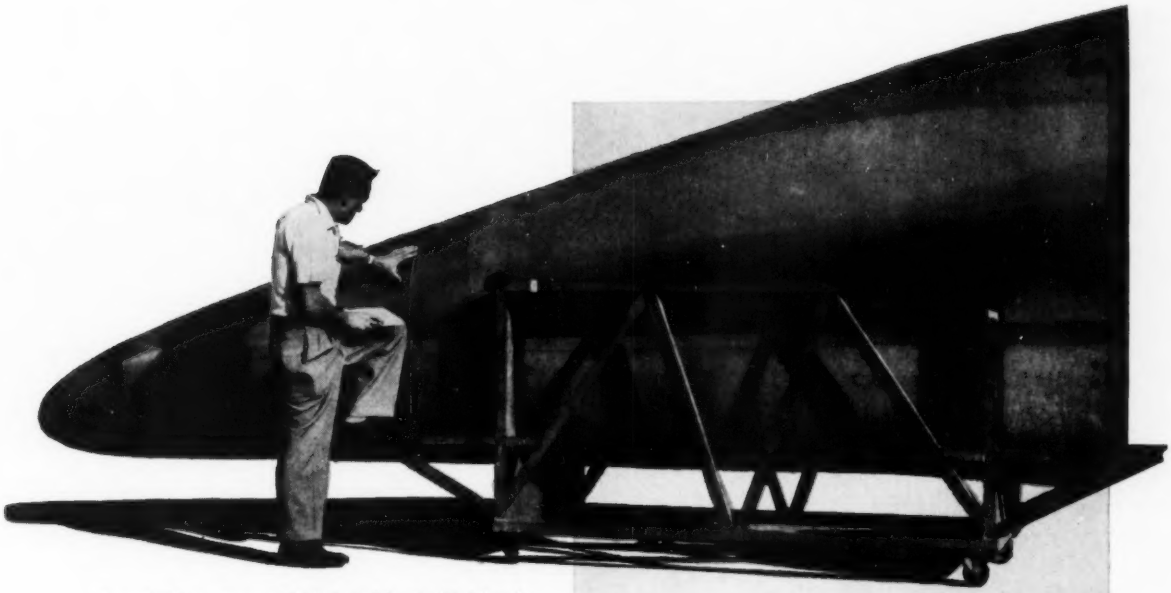
Epoxies—Casting resins for encapsulation and embedment of electronic components and circuit assemblies are described in this 14-page brochure. The resins—epoxies and modified epoxies—are offered in a number of different formulations, some of which can be cured at room temperature. The resins are said to have good adhesion to metals and most plastics, low moisture absorption and vapor transmission, and to retain their mechanical properties over a temperature range from −60 to 200° C. The brochure also provides information on the technique of potting electronic components. *Aries Laboratories, Inc., 270 Park Ave., New York 17, N. Y.*

Heat indicators—Catalog 6709 on remote bulb thermometers covers selection data, recorders and indicators, pneumatic control, electric control, program (preset cycle) control, psychrometers, bulbs, tubing, and fitting. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

Polyesters—The company's complete line of polyester resins is covered in this 20-page booklet. Information is given on their properties and production techniques. A number of suggested applications are listed. *Celanese Corp., of America, 180 Madison Ave., New York 16, N. Y.*

Urea—A new process for the production of urea, said to result in lower operating costs, reduced initial investment, higher yields, high on-stream efficiency, and high product purity, is described in this 8-page booklet. The process, developed by the Montecatini Group, consists of a partial re-cycle system which utilizes a special expansion-condenser unit to recover nearly 75% of unreacted ammonia and carbon dioxide. These are re-cycled as a solution in fresh ammonia and steam condensate. The process is reported also to reduce corrosion problems usually associated with urea manufacture. *The M. W. Kellogg Co.* (exclusive licensor of this process in the United States), *Chemical Process Div., 225 Broadway, New York 7, N. Y.*

Machinery catalog—A line of impact-type grinding mills employing hammers, and a line of feeders designed for continuous feeding of damp and oily materials and dry solids having a tendency to bridge and arch in conventional hoppers is described in this 32-page catalog. The mills, called Pulva-Sizers, come in a range of ½ to 100 hp., and are for use in fine grinding, granulating, wet milling, and close particle size control. The hoppers, called Com-Bin feeders, are volumetric-type



Navy bomber stinger tail fabricated by Zenith Aircraft—Division of **Zenith Plastics Co.**, Gardena, California.

Can *your* designs duplicate this 80% saving with REINFORCED PLASTICS?

Five of these big reinforced plastic stinger tails for the price of one made from conventional materials! The tails carry submarine detection devices for the Lockheed P2V Neptune.

The great savings result from fewer engineering man-hours at the design stage, use of less expensive tooling and manufacturing equipment, greatly simplified fabrication techniques, even for complex designs, faster production cycles, and the need for considerably less factory floor space.

And look at the size—seventeen feet long! Virtually no stringers, frames, bulkheads or fittings are used.

Reinforced plastics, made with glass cloth and BAKELITE Polyester Resins, are so strong that this structure withstood tests up to 300 per cent of its design load.

Your product may gain similar worthwhile design advantages from these properties of reinforced plastics:

- They can be easily fabricated into relatively large sections.
- They have a high strength-weight ratio.
- They possess both thermal and electrical insulating properties.
- They resist corrosion, chemicals, moisture, oil, and grease—are easy to keep clean.
- Their economies include low-cost tooling, savings in freight, assembly, and handling, and long service life.

Learn more about BAKELITE Polyester Resins for reinforced plastics. Write Dept. XC-13 for free descriptive literature.

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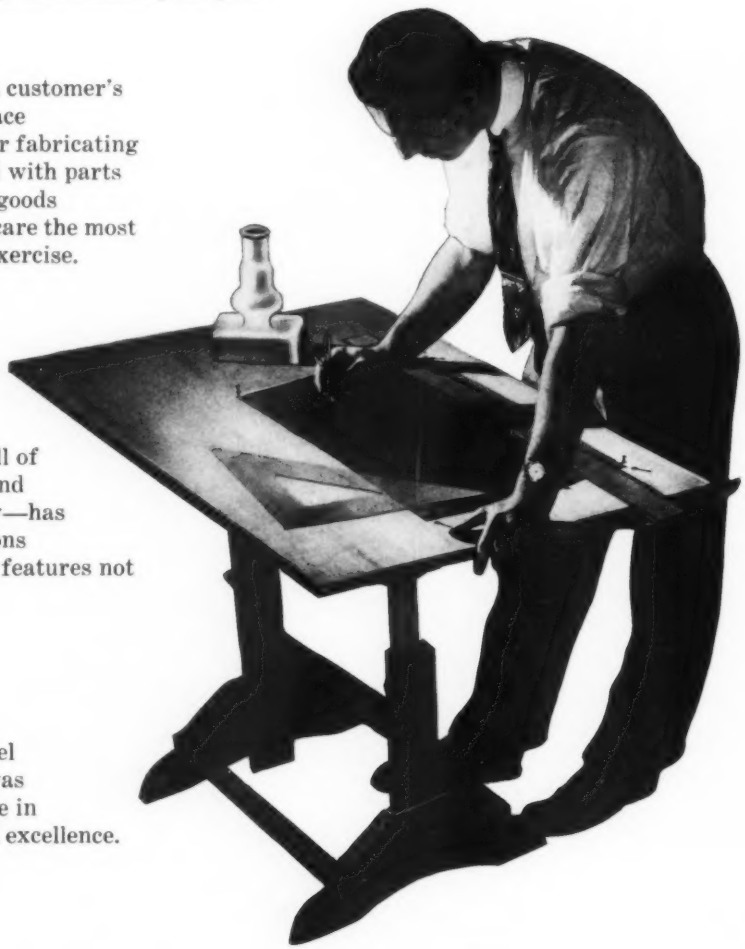
BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

Facts for Buyers of Injection Moulded Plastics

FACT: Every die WMP uses is designed and built in our plant by our staff engineers and skilled die makers . . . a practice which results in single responsibility, better mouldings, easier fabrication and, in the final analysis, greater economy for you.

FACT: WMP often serves as part of a customer's factory. A good portion of our floorspace is devoted to conveyorized facilities for fabricating and assembling components we mould with parts which have been shipped in. Finished goods are inspected and packed with all the care the most discriminating manufacturer would exercise.



FACT: With only minor exceptions, all of our injection moulding equipment—and it ranges from 8 to 375 ounce capacity—has been built by us to our own specifications and includes many special production features not found in standard machines.

FACT: All WMP supervisory personnel have been with the company since it was founded in 1939. They take great pride in turning out mouldings of unsurpassed excellence.

You're in Good Company at WMP

Custom Injection Moulders

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feeders, and come in models with feed rates ranging from a few grams per minute to 75 tons per hour. *Pulva Corp., 550 High St., Perth Amboy, N. J.*

Vinyl chloride—Product design possibilities which can be realized through use of the company's elastomeric vinyls are outlined in this 16-page booklet. Numerous applications in the automotive, appliance, furniture, houseware, toy, sporting goods, and other fields are suggested for items injection molded of this material. *Monsanto Chemical Co., Plastics Div., Springfield, Mass.*

Project development—Architectural and engineering services offered by the company for all phases of a construction project are outlined in a booklet entitled, "Engineering for the Rubber and Plastics Industry." In addition to strictly architectural-engineering problems, the organization also renders services in connection with the selection, design, and arrangement of equipment for efficient and economical manufacture of specified products. The booklet includes a list of representative projects which the company has completed. *Giffels and Vallet, Inc., 1000 Marquette Bldg., Detroit 26, Mich.*

Molding presses—Catalog 525 lists the company's complete line of presses for fully automatic and semi-automatic molding, for preforming, and for extrusion. Two recent additions to the series of straight-ram compression and transfer molding presses (50- and 300-ton models) are also described. Specifications and suggested applications are presented with each listing. *F. J. Stokes Machine Co., Philadelphia 20, Pa.*

Drills—Catalog Sec. B1 lists a line of industrial drills, including drills for use with molded plastics. Diameters and over-all lengths are given for each type presented. *The DoALL Co., Des Plaines, Ill.*

Polyester resins—New edition of "Polyester Resins for Reinforced Plastics" includes descriptions of the company's new resins, BRS 264 and BRS 265, both medium-viscosity, rigid-type resins. Information on formulation, reinforcing materials, compounding, production methods, release agents, and fabrication, contained in the earlier edition, see MODERN PLASTICS *30*, 162 (June 1953), has been carried over into the current printing. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Stabilizers—Technical Bulletin No. 39 presents property and application information on the company's vinyl stabilizer No. 180-X, an experimental barium laurate compound for use in applications where more flexibility or a lower concentration of fatty-acid-based stabilizers is desirable. It is particularly recommended for use in combination with Stabilizer No. 203-X, an experimental formulation based on cadmium and "chelate"-type stabilizers. Properties and applications of stabilizer No. 203-X are outlined in Bulletin No. 40. It is reported to contribute toward better heat and light stabilization and to aid in cases where difficulties are encountered in processing or in color retention of light tones. The manufacturer states that Stabilizer No. 203-X, when used in combination with relatively low concentrations of Stabilizer 180-X, reduces development of yellowness in both clear and pigmented film and sheeting. *Ferro Chemical Corp., P. O. Box 349, Bedford, Ohio.*

Mill drives—Bulletin GEA-5887 describes and lists advantages of a line of plastics and rubber mill drives. The drives are equipped with 100- to 1000-hp. enclosed synchronous mill motors (for continuous operation) and mill control (for interruption capacity to protect against short-circuit currents). *General Electric Co., Schenectady 5, N. Y.*

Instruments—Bulletin F 5633-1 describes a complete line of instruments for industrial process control application. Included in the 4-page booklet is information on recorders, controllers, indicators, combustion safeguards, temperature shut-offs, positioning controls, and pyrometer control accessories. *Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.*

Paint additive—Uses and properties of Nuosperse 657, a wetting, dispersing, and anti-settling agent, are described in this brochure. According to the maker, the compound is effective over a broad range of paint formulations, has auxiliary film forming characteristics, and has no known deleterious effect on the final product. Booklet includes a table of physical constants and price and ordering information. *Nuodex Products Co., Inc., Elizabeth, N. J.*

Adhesive—How various manufacturers use a rubber-based phenolic cement for applications ranging from heavy-duty to delicate jobs is described in this folder. The water-, chemical-, and oil-resistant cement is said to give flexible bonds which will withstand 1500 p.s.i. pull. *Chemical Div., The Goodyear Tire & Rubber Co., Akron 16, Ohio.*

Plastics—Bulletin 123 gives a thumbnail sketch of plastics, their history, their development, and their various applications. It also discusses, in a general way, the different molding procedures used with plastics. 25¢. *Engineering Extension Service, Iowa State College, Ames, Iowa.*

Closures—A line of elastomeric vinyl plugs and caps for use in sealing openings and tube ends during shipping, maintenance, and storage is described in Bulletin P-5312. Plugs fit hole diameters from ¼ to 1 in., caps fit tube diameters from $\frac{3}{32}$ to 1 in., and tapered pipe plugs fit pipe with internal N.P.T. pipe threads from ⅛ to ¾ inch. *The S. S. White Dental Mfg. Co., Plastics Div., 10 E. 40th St., New York 16, N. Y.*

Plasticizer—Results of a study of epoxy fatty acid esters for use as vinyl plasticizers are presented in Bulletin 56. Text, tables, and photos give plasticizer performance of these esters with respect to modulus of elasticity, tensile strength, elongation, hardness, efficiency, low-temperature flexibility, permanence, and light stability. Test results indicate good general plasticizer performance combined with an inherent stabilizing action for chlorinated polymers. *Buffalo Electro-Chemical Co., Inc., 34 Sawyer Ave., Station B., Buffalo, N. Y.*

Tools—Illustrated catalog gives information on carbide tipped saw blades, router bits, and hand router tools. Cutting results that may be

Cut Color Costs!

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Saves as much as 5½¢ per pound!

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Prevents inventory losses and costs!

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Eliminates production delays!

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Increases molding equipment capacity!

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UNICOLOR, the revolutionary resin color concentrates, comes in granulated or pellet form. *No special mixing equipment is required* — Any operator without special extrusion training can mix UNICOLOR. Color and molding is simultaneous. They form a molecular bond by fusing and thoroughly distribute a uniform color throughout the thermoplastic.

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UNICOLOR does *not* produce blemishes, blisters, mottling, streaking, or bleeding. It does not fly—will not contaminate other machines. No more clogged screens with UNICOLOR.

A wide range of popular and approved NEMA colors are available. Special colors are scientifically matched.

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PLASTICS, INC.
MAMARONECK, N. Y.

obtained in working decorative plastics with these tools are described, and the type of machine to which each style of blade is best adapted is listed. *North American Products Corp., Edwardsville, Ill.*

Tools—Information on die-stamping phenolic and other non-metallic tools to specifications is presented in this four-page folder. *Federal Tool & Mfg. Co., 3600 Alabama Ave., Minneapolis 16, Minn.*

Vinyl—Compounding, processing, and applications of the company's vinyl resins are given in this 52-page brochure. Future prospects for this material are also presented. *Chemical Div., The Goodyear Tire & Rubber Co., Akron, Ohio.*

Polyethylene—Information on properties of and processing methods for polyethylene are presented in this 8-page folder. Photographs showing applications for packaging, wire covering, housewares, pipe, and industrial products are reproduced. Data on polyethylene molding compounds blended with colorants and anti-oxidants are also given. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Plasticizers—Two technical bulletins give specifications, performance data, and typical formulations for two primary plasticizers. Bulletin E-6 deals with dioctyl phthalate (D.O.P.), a plasticizer compatible with all common vinyl polymers and most cellulosic plastics, as well as synthetic and natural rubbers, Bulletin E-7 discusses di-iso-octyl phthalate (D.I.O.P.), a plasticizer having generally the same characteristics and compatibilities as D.O.P. Both plasticizers may be used interchangeably. *Witco Chemical Co., 260 Madison Ave., New York 16, N. Y.*

Test equipment—Bulletin 4211 describes and illustrates a pendulum-type impact machine with a capacity of 48 ft./lb. for testing plastics materials. The unit operates on the principle that the difference between the angle of rise when the pendulum swings free and the angle of rise after it has broken a specimen is a measure of the energy absorbed in

breaking the specimen. It is adapted for Charpy, Izod, and tension tests, and a slotted and ground base simplifies the use of special fixtures for other tests. Floor space required for the instrument is 20 by 72 inches. Complete specifications are included in the bulletin. *Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.*

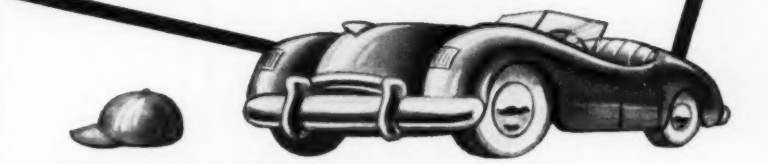
Belt drives—Data necessary for the calculation, by a new method, of horsepower capacity of the company's V-belt drives are listed in Bulletin 20B6956B. The resulting belt ratings take into consideration effect of belt length, ratio of diameters of both the driving and driven sheaves upon the horsepower rating of the belt, and resultant belt life. The company states that all sheave and V-belt manufacturers have approved and accepted the belt horsepower ratings derived by this method. *Allis-Chalmer Mfg. Co., 1163 S. 70th St., Milwaukee, Wis.*

Vinyl chloride—Chemical Safety Data Sheet SD-56 gives properties and essential information for the handling, storage, use, and waste disposal of vinyl chloride. It includes a section on health hazards and their control. Necessary plant and engineering procedures for cleaning and repairing tanks and equipment used with vinyl chloride are discussed. 25¢. *Manufacturing Chemists' Associations, 1625 Eye St., N. W., Washington 6, D. C.*

P.V.C.—A series of polyvinyl chloride resins and the applications for each type are described in this 6-page booklet. Also included are graphs and tables on various properties of the material, supplied by the company as unformulated powder for calendering or extruding operations. *The Dow Chemical Co., Midland, Mich.*

Styrene—A new formulation of general purpose styrene is described in this technical bulletin; properties, molding considerations, finishing requirements, and applications are listed. This new material is said to flow faster and more evenly throughout the mold, making it particularly applicable for the molding of intricate or thin-walled parts or deep sections. *Plastics Technical Service, The Dow Chemical Co., Midland, Mich.*

EEMCO REINFORCED PLASTICS MOLDING PRESSES for EVERY TYPE JOB



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Exclusive design features plus exceptionally fast deliveries make EEMCO reinforced plastics presses your best buy. Standard or Special Presses available.

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Used by many of America's foremost reinforced plastics molders

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The manufacture of molded plastics for devices for military requirements is one of our specialties . . . thousands of military parts are in present production.

Considerate and experienced handling of your plastic molding problems is available thru ACCURATE SERVICE where you will find ample, modern facilities to meet your every plastic molding requirement . . . at MAXIMUM efficiency and economy.

SEND your specifications NOW! We invite your toughest problems. . . . . NO OBLIGATION

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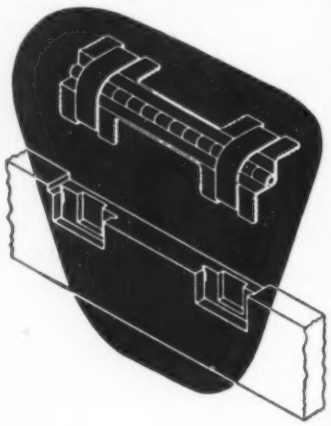
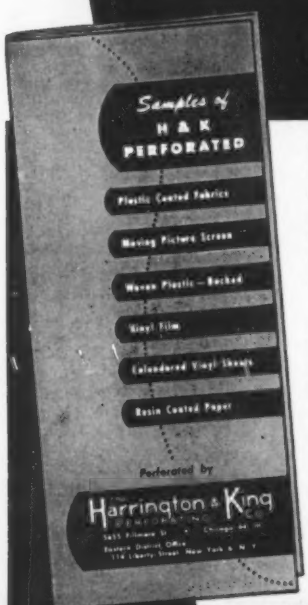
for PLASTIC BOXES

press-fit assembly
(Holds like
a drive-screw)
with
or without
double action
"C" Springs



GEISSEL *Mfg. Co., Inc.*
109 LONG AVENUE
HILLSIDE, N. J., U. S. A.

The PERFORATING of PLASTICS



This folder of perforated swatches includes samples of various forms of plastics available as coated fabrics, vinyl sheet and film, resin coated paper and woven plastic fibers—all perforated with various sizes and spacings of holes.

The perforating provides ventilation and air escape for upholstery, sound escape for moving picture screens, light transmission for advertising signs as well as for decorative and many industrial purposes.

With 68 years of experience we are prepared to meet the requirements of the plastic industry when perforating is required.

Send for this folder of samples —gratis.

The Harrington & King PERFORATING Co

5680 Fillmore St., Chicago 44, Ill.
114 Liberty St., New York 6, N. Y.

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant, for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials
CELLULOSE PLASTICS:[a]
Cellulose acetate and mixed ester:
Sheets, under 0.003 gage
Sheets, 0.003 gage and over
All other sheets, rods, and tubes
Molding and extrusion materials
Nitrocellulose sheets, rods, and tubes
Other cellulose plastics
PHENOLIC AND OTHER TAR-ACID RESINS:
Molding materials[a]
Bonding and adhesive resins for—
Laminating (except plywood)
Coated and bonded abrasives
Friction materials (brake linings, clutch facings, and similar materials)
Thermal insulation (fiber glass, rock wool)
Plywood
All other bonding and adhesive uses
Protective-coating resins, unmodified and modified except by rosin
Resins for all other uses
UREA AND MELAMINE RESINS:
Textile-treating and textile-coating resins
Paper-treating and paper-coating resins
Bonding and adhesive resins for—
Plywood
All other bonding and adhesive uses, including laminating
Protective-coating resins, straight and modified
Resins for all other uses, including molding
STYRENE RESINS:
Molding materials[a]
Protective-coating resins, straight and modified
Resins for all other uses
VINYL AND VINYL COPOLYMER RESINS, total[b]
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for—
Film (resin content)
Sheeting (resin content)
Molding and extrusion (resin content)
Textile and paper treating and coating (resin content)[c]
Flooring (resin content)
Protective coatings (resin content)
All other uses (resin content)
All other vinyl resins for—
Adhesives (resin content)
All other uses (resin content)
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:
Molding materials[a,d]
Protective-coating resins[e]
Resins for all other uses[f]

* Dry basis is designated unless otherwise specified.
** Partially estimated.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

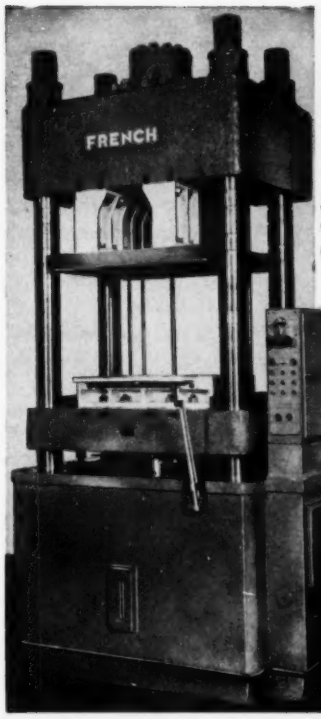
Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR 1953 AND JANUARY 1954
by U. S. Tariff Commission

Preliminary total, 1953		*January***	
Production	*Sales*	*Production*	*Sales*
17,471,732	17,165,325	1,453,336	1,310,025
14,057,691	13,143,600	838,564	750,273
5,868,619	5,244,506	455,559	434,583
77,694,859	76,880,643	5,367,375	5,682,274
7,597,315	6,548,906	562,662	523,853
6,272,178	6,427,044	412,462	456,863
225,983,102	208,085,212	15,232,036	14,654,740
70,468,339	46,698,384	4,981,926	3,283,044
13,248,461	12,124,449	829,939	888,634
18,363,578	16,277,269	1,373,356	1,241,822
20,657,403	20,431,691	2,296,636	2,531,499
36,987,445	33,758,662	2,468,147	2,415,189
17,750,231	17,168,151	1,712,441	1,755,082
28,058,499	25,352,936	1,797,481	1,881,828
28,651,357	22,696,112	1,947,362	1,373,239
30,667,670	30,898,468	2,849,432	1,544,234
21,298,711	21,539,818	1,750,912	1,588,999
52,869,090	51,141,213	5,150,160	4,397,845
42,132,416	43,185,550	1,876,367	2,157,028
29,744,531	22,554,579	2,103,669	1,585,701
65,911,516	64,929,457	6,019,551	4,890,874
322,744,036	295,018,981	23,633,302	24,770,378
84,471,641	82,126,632	6,675,547	6,534,260
85,037,524	74,261,774	7,307,367	7,308,475
511,395,074	480,299,084	40,636,166	37,130,905
—	63,690,980	—	4,868,972
—	62,384,850	—	5,435,105
—	129,215,208	—	10,120,169
—	52,353,452	—	4,637,739
—	22,152,315	—	910,648
—	22,822,583	—	1,614,062
—	27,790,074	—	1,730,594
—	22,411,337	—	1,825,552
—	77,478,275	—	5,988,064
176,977,021	172,635,977	14,333,495	14,982,662
150,654,467	129,884,365	15,826,383	13,815,403
8,241,676	4,786,812	338,771	343,197
110,718,982	115,654,545	8,708,964	9,415,643

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [f] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



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The Liberty Vinyl and Pyroxalin Embosser comes in models up to 60" wide. Full particulars will be sent on request. Liberty Machine Co., 275 Fourth Avenue, Paterson 4, New Jersey.

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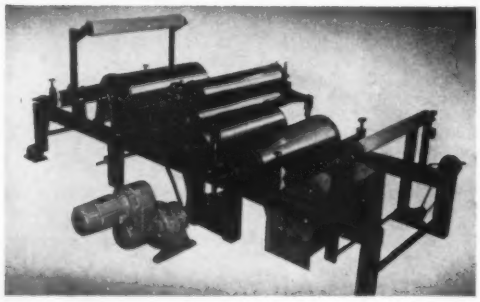
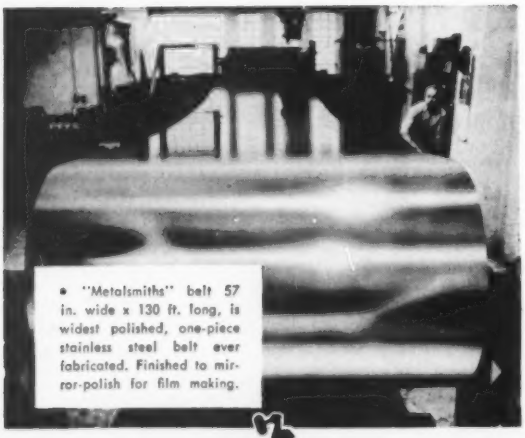


Endless Stainless Steel Belt Speeds up and improves Cooling—Setting—Conditioning

Automatic Contact-Gloss!

Polished stainless steel belt provides high gloss as materials move thru cooling and conditioning.



• "Metalsmiths" belt 57 in. wide x 130 ft. long, is widest polished, one-piece stainless steel belt ever fabricated. Finished to mirror-polish for film making.

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METALSMITHS STAINLESS STEEL ENDLESS CONVEYOR BELTS

Tubing Harness

EXTRUDED polyethylene tubes sheathed in an extruded vinyl harness make for practical and economical installation of air lines for actuating pneumatic control and recording instruments used in the chemical and other processing industries.

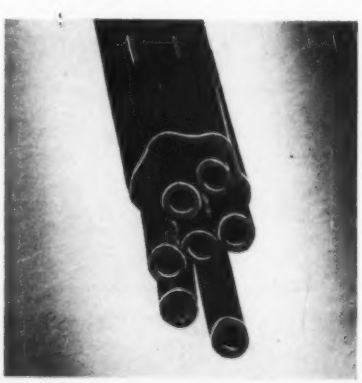
Through use of the plastics harness, installation of the many miles of instrument lines required in some plants is greatly simplified. Each tube in the harness is clearly color-coded, thereby eliminating the need for identifying each individual line during installation by various field tests. The costs of installation are thus considerably lowered. Another advantage of the harness is that it is completely resistant to attack by corrosion.

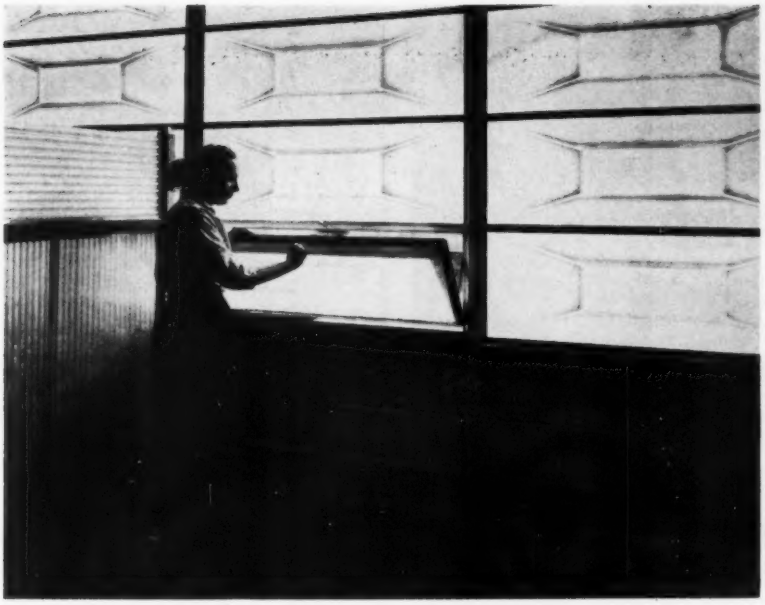
In the manufacture of the harness, which is sold in standard 500-ft. lengths, polyethylene tubes are first extruded in a variety of bright colors. Each tube has a 1/4-in. O. D. and a 0.040-in. wall thickness. Depending upon the eventual application of the harness, the tubes are placed in combinations of 4, 7, 10, 14, or 19, and an outer vinyl sheath, 1/16 in. thick, is extruded over them. Larger polyethylene tubes, with a 3/8-in. O.D. and a 0.062-in. wall thickness, are produced for special applications.

Fittings that have been especially designed for use with the plastic harness are also available from the manufacturer.

CREDITS: Dekoron Impervapak Poly-Cor is made by Dekoron Products Div., Samuel Moore & Co., Mantua, Ohio

Color-coded polyethylene tubes are compactly sheathed in vinyl harness





Molded-in design of polyester-fibrous glass windows adds structural rigidity and at the same time acts to transmit glare-free light in constantly changing patterns

Plastic Windows Curve Outward

SHATTERPROOF, translucent reinforced plastics windows that curve outward for strength and to refract sunlight, find use in industrial and public buildings.

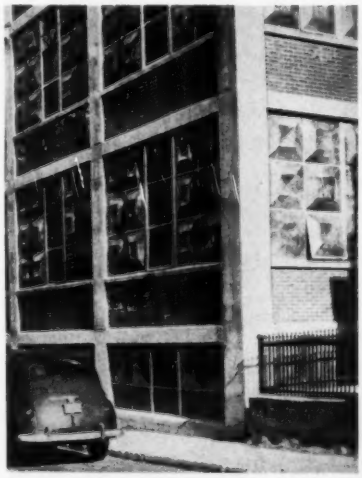
The new windows transmit a diffused, glare-free light that is broken up into constantly changing patterns by a design molded into the outside face of the window. This design, usually diamond-shaped, is formed by several planes facing at different angles and can project outwards as much as 3½ inches.

Since a curved window has more surface for transmission of light than a flat pane, it is claimed that about 78% of available light is transmitted through the new windows. In a storm, the unusual design of the rugged fibrous glass-polyester resin laminate serve still another purpose. Wind pressure against that section of the window that curves outward actually tightens the unit in its frame. In addition, the various planes in the design promote the flow of rain water over the window and flush away dirt.

The windows can be installed from the inside of the building by simply applying putty to the frame and snapping the window into place.

Two window styles are currently in production—a square window up to 3 sq. ft. in size made from a $\frac{1}{16}$ in. thick laminate and a casement-type window made in various sizes to fit standard casement frames. Skylights, 3 by 6 ft. in size, are also in production.

CREDITS: Windows produced by Molded Insulation Co., Philadelphia, Pa., using Vibrin polyester resin supplied by Naugatuck Chemical Div., U. S. Rubber Co.



Industrial plant with shatterproof polyester-fibrous glass windows

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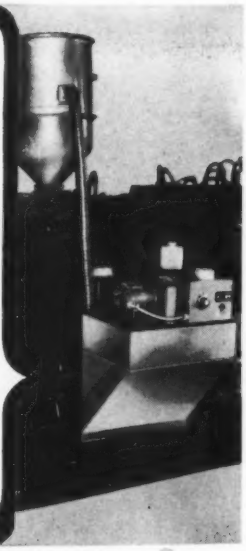

Efficient pre-heating and de-humidifying of material is just one of many jobs done by this timesaving accessory. It speeds production by eliminating handling—because material goes directly to the machine from receiving. No need to load and unload drying ovens. You save floor space, too, because the Hopper-Dryer can be installed easily on standard makes of injection or extrusion machines. Initial cost is less than a drying oven's. Operating cost is low, results are sure.

New Hopper Loader — For continuous automatic feed of any injection or extrusion machine. Clock timer control for starting and stopping. Dust-free operation.
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Windshield Cover

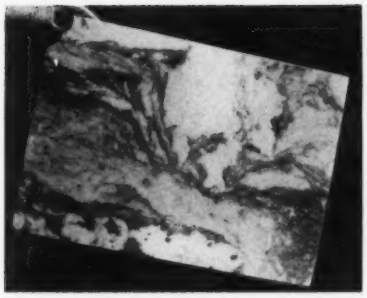
ACRYLIC canopies and windshields of military aircraft are protected from physical damage during ground storage by flexible vinyl coated fabric covers.

Consisting of a soft, flannel-like broken twill fabric coated with either an olive drab or an aluminum colored vinyl plastisol, the covers were made to meet the requirements of Military Specification MIL-C-7642 (USAF). When in use on Cessna Air Force liaison planes, the covers are securely lashed with ropes to the planes after they have landed and are to be stored in the open for any length of time. Once tied in place on the aircraft, the vinyl-coated fabric covers protect the acrylic surfaces from severe dust and sand storms, direct sunlight, rain, ice, and snow. They also protect the canopy and windshield from careless man-made scratches that might distort visibility through the acrylic.

The waterproof covers, which are equally satisfactory for use in hot or cold climates, are resistant to flame, to fungus, and to the effects of grease, oil, acids, alkalies, cleaning solutions, and most common solvents.

CREDITS: Fabric cover coated by H. M. Sawyer & Son Co., Coated Fabrics Div., Watertown, Mass. Geon vinyl plastisol supplied by B. F. Goodrich Chemical Co., Cleveland, Ohio.

Vinyl coated fabric cover protects acrylic windshield from physical damage
Courtesy B. F. Goodrich Chemical Co.



Simulated marble is made by combining polyester resin and glass mat

"Marble" Surface

A POLYESTER "marble" that duplicates the beauty and delicate graining of natural marble, yet is more economical and more practical for many household and business uses, is now available for professional decorators and home handymen.

The material, called Cali-Marb, consists of a combination of polyester resin, fibrous glass mat, a sheet of white paper laminate, and marble dust. In the manufacture of the product, a layer of fibrous glass mat, which duplicates the characteristic marble veining, is first applied to the paper laminate. This layer is then surfaced with a thick coating of polyester resin. The marble dust is applied as a filler to the back of the paper laminate, but has no part in producing the veining.

The polyester "marble"—available in several colors—is delivered in standard sheet sizes of 24 by 48 in. for resurfacing tables; for decorating lamps, columns, and radiators; for remodeling bathrooms; etc. Other sizes, however, are available on request.

The sheets are easy to cut with most standard saws and can be applied to a surface in a matter of minutes using adhesive or, for exterior applications, regular mortar. Once installed, the polyester marble sheets present a handsome, durable surface. The shatter-resistant sheets are impervious to weather, mildew, rot, and most chemical fumes. They will not burn, are easy to clean, and do not require polishing to maintain a glossy surface.

CREDITS: Cali-Marb is a product of Caligari Products, Norfolk, Va.; polyester resin is supplied by Marco Resins, Plastics Div., Celanese Corp of America.

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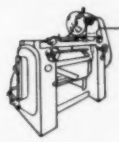

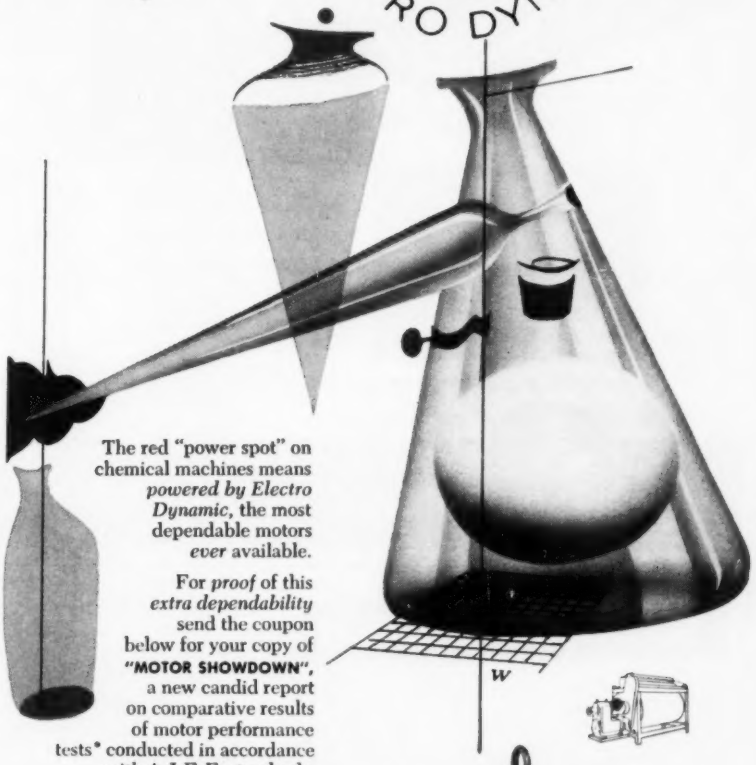

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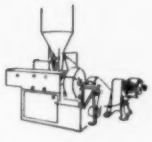

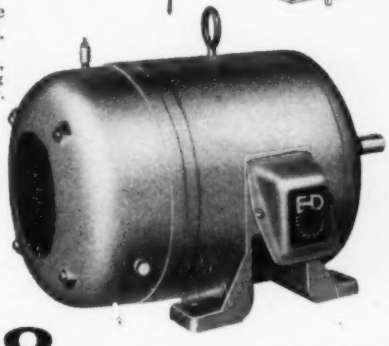

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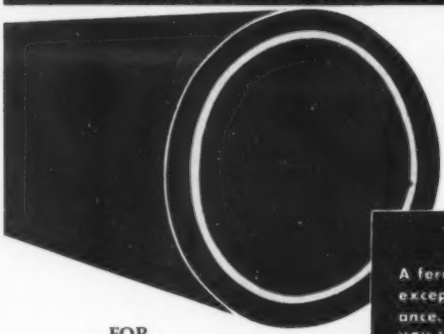

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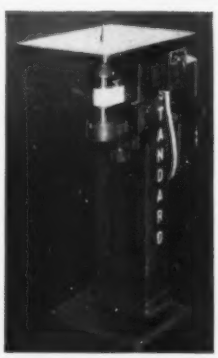
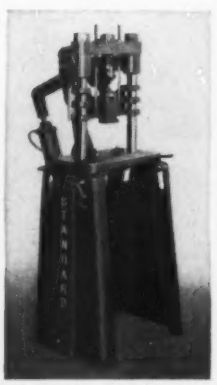


Bevelers—2 Sizes



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Nylon Salad Set

A NEW line of salad serving spoons and forks, consisting of molded nylon bowls fitted into hollow silver handles, combines outstanding durability with luxurious appearance. Over-all length of set, with handles attached, is 11 inches.

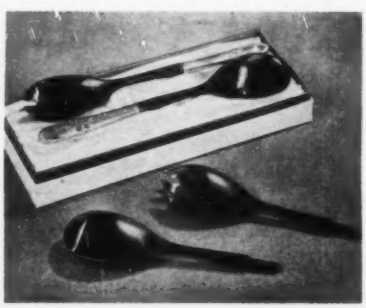
In the production of the utensils, the one-piece bowl and stub for both the large spoon and the flat three-tined fork are injection molded at the same time in a two-cavity mold. The position of the cavity for each of the parts is reversed in the mold—the bowls are located at opposite ends—to facilitate gating for equal distribution of material.

At the base of each nylon part is a small molded-in stub just large enough to fit snugly into the center of the sterling silver or silver plated handle, where it is permanently fixed in place. The silver handles are available in many of the same patterns supplied for various other settings in the company's line.

In addition to the durability of the nylon salad set in use, the spoon and fork are completely impervious to the sulfur and food acids that are usually contained in salad dressings.

The molded black nylon parts provide an attractive contrast to the silver handles and are easy to clean after the serving set has been used. The nylon can also be easily polished with a soft cloth to a bright luster.

CREDITS: Nylon salad spoon and salad fork are molded for Oneida Ltd., Oneida, N. Y., by Shaw Insulator Corp., Irvington, N. J., on an 8-oz. Reed-Prentice machine. Black FM 10001 nylon supplied by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.



Durable serving utensils are made of nylon bowls set in silver handles

Driver's seat of bus is upholstered with cotton-backed, porous vinyl

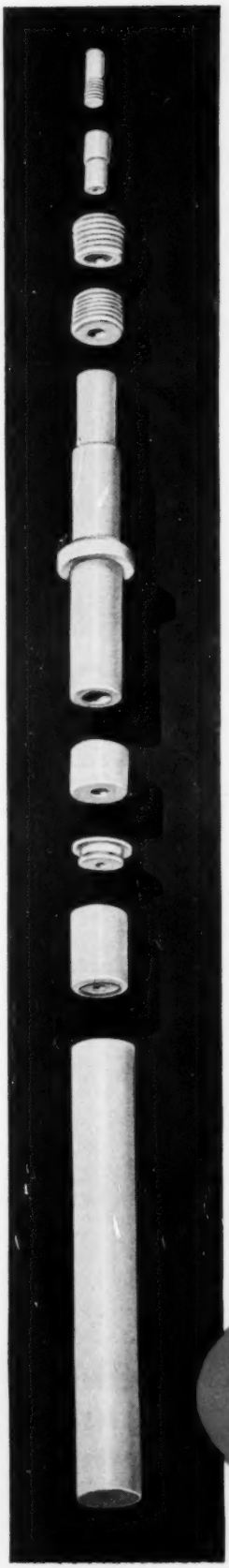
Porous Vinyl

COTTON-BACKED vinyl upholstery material that is porous is especially adaptable for use in transportation seating and institutional, home, and office furniture. It is claimed to improve seating comfort when used over foam rubber cushioning or deep springs.

The material is produced on special machinery in four colors—turquoise, gray, dark green, and maroon—and can be made in a variety of other colors, textures, and patterns. It is sold in 30-yd. rolls, 54 in. wide. Since the material won't absorb dust and can be cleaned with a damp cloth, it is also very easy to maintain.

CREDITS: "Breathing" Naugahyde is a product of U. S. Rubber Co.

Smoke blown through "breathing" vinyl demonstrates porosity of material



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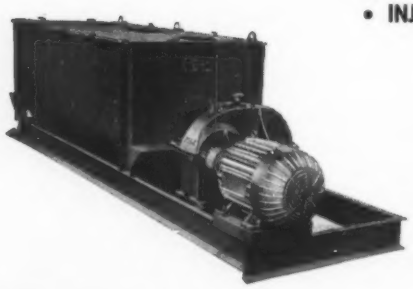

The BAILEY RIBBON BLENDER releases your expensive capital machines from simple mixing jobs. At a nominal cost in comparison to your capital investment, it actually increases the capacity of your major machinery.

Bailey machines have more efficient cleaning details, empties quicker, more thoroughly, new mixing element increases mixing intensity. Jacketed machines available for high temperature work.

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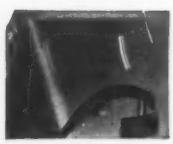

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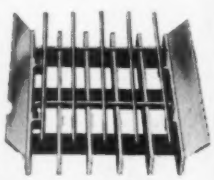
for quicker, more complete cleaning — eliminates contamination between batches.

MAGNETIC GRATE SEPARATOR
PREVENTS UNNECESSARY DAMAGE TO EQUIPMENT

The Magnetic Grate consists of highly saturated permanent type Alnico No. 6 magnets and intervening steel bars.
Placed in the throat of the hopper, the grate attracts every ferrous object from material being loaded in the machine. Retaining this and other large debris of all kinds—rags, sticks, stones, paper, etc., it helps prevent damage to expensive machinery.
The grate can readily be lifted out for removal of tramp iron and debris. The Magnetic Grates are available in sizes from 2" x 4" up to 8 feet square. Any size or shape can be furnished to meet unusual requirements.



R. N. BAILEY & CO., INC. 11 W. 42nd St. New York 18, N. Y.

Weed Control

RIDDING a lawn of weeds becomes less of a back-breaking proposition with the use of Killer Kane, a 34 in. long tubular device for applying a weed-killing solution to broad-leaved lawn pests as the user walks along.

Two plastics are used in the production of the lethal instrument: tough, impact-resistant, lightweight butyrate for the extruded transparent tube which holds the solution and for the molded nozzle which attaches to the bottom of the tube and through which the solution is dispensed; resilient, pleasant-to-the-touch polyethylene for the molded removable cap which closes off the tube at the top.

To apply the weed-killing liquid spray, a spring-loaded brass plunger, protruding from the bottom of the nozzle, is placed on the weed to be eradicated and the instrument pressed down. This pushes the plunger rod up into the nozzle, lifting a plunger disk, and releasing the liquid which sprays on the weed. Releasing pressure on the tube returns plunger to its normal position.

CREDITS: Killer Kane manufactured for Donaldson Co., Inc., St. Paul, Minn., by Minnesota Plastics Corp., St. Paul; butyrate tubing extruded by K-S-H Plastics, Inc., High Ridge, Mo., and Nebraska Plastics, Inc., Cozad, Neb., from Tenite II cellulose acetate butyrate marketed by Eastman Chemical Products, Inc. Polyethylene supplied by Bakelite Co., and E. I. du Pont de Nemours & Co., Inc.

Applicator for weed-killing solution has butyrate and polyethylene parts

Rugged collapsible vinyl tubes have numerous packaging applications

Vinyl Tubes

COLLAPSIBLE tubes made of vinyl offer the packaging field an economic replacement for conventional metal tubes.

While the cost of the vinyl tube runs about the same as tin, lead, or aluminum containers, the advantages gained and savings effected by using the new tubes are many. Despite the fact that the vinyl tubes weigh only about 1/3 as much as lead containers, they are exceptionally rugged and can withstand rough treatment in handling or shipping. They will not burst from expansion of contents caused by temperature changes nor will they deteriorate in storage.

The plastics containers can stand up to 250° F. before softening and special formulations are available which remain flexible at temperatures as low as −65° F. The wrinkleproof tubes can be supplied either transparent or opaque and in any color. Labels can be printed directly on the vinyl surface.

The vinyl tubes are supplied to the customer with the bottom end open. After they are filled on conventional tube-filling equipment, the customer heat-seals the bottom end on a special adaptor supplied by the manufacturer.

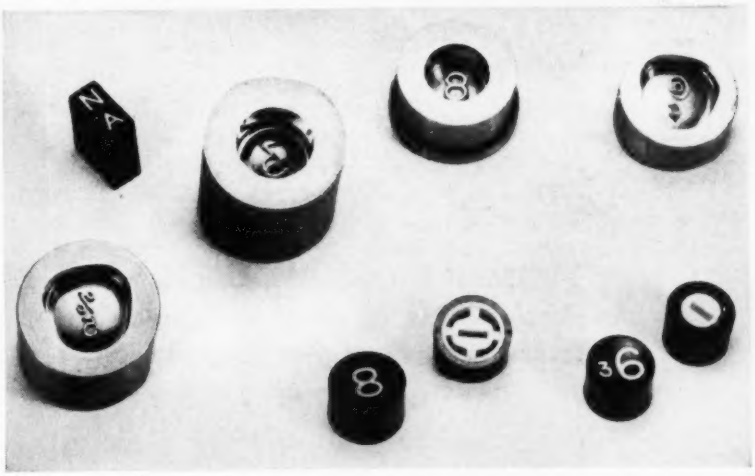
One big market that has developed for the tubes is in the packaging of oil paints. Other fields of application that are expected to expand are in the packaging of lubricants and medical and pharmaceutical products. Of prime importance to the two latter fields is the fact that the tubes can be sterilized in boiling water.

CREDITS: Vinyl tubes are made by Wallace Container Co., Los Angeles, Calif., using Geon vinyl resin supplied by B. F. Goodrich Chemical Co.

Thousands of These Parts Produced Each Day

Molds In *Constant Production*

Show No Visible Signs Of Wear



"We have yet to find a steel equal to Samson Extra for our hobbing requirements where a mold with high tensile strength is needed" . . . reports Stott Tool and Machine Company who made the molds for these typewriter and adding machine keys. Samson Extra provided higher core strength and more uniform surface hardness than the steel previously used. It hobbed very easily . . . machined readily with no tearing. The molds polished to a high lustre with standard polish compound and ordinary cleaning powder. No chrome plating was necessary.

If you've ever wanted to profit by hobbing more cavities, but felt that mold strength or performance would suffer with a regular hobbing steel, let Samson Extra prove differently. As in the job described above, Samson Extra's combination of *excellent hobability, good machinability,* and *extra high strength* can pay off for you. No other mold steel offers you the economies of hobbing with these dependable results on the job—long production runs, high lustre finishes, freedom from sinking. To get started, call your nearby Carpenter Mill-Branch Warehouse now.

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CASE-HARDENING ALLOY MOLD STEEL FOR HOBBED & MACHINED MOLDS & FORCE PLUGS

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EFFECTIVELY and ECONOMICALLY

Metal & Thermit's active research on the flame-proofing of vinyls has yielded a retardant filler that offers "4-way-appeal" to producers of vinyl plastic products.

1. *M & T Antimony Oxide is low in initial cost . . .*
2. *. . . is economical to use—compared with other systems smaller quantities are needed for effectiveness . . .*
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Formulate with practical, efficient M & T Antimony Oxide. For applications where low pigmentation is necessary a special flame-retardant antimony compound will be furnished.

Specific advice, technical data and samples are available on request. Write M & T today.

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Shape a Sheet

(*Continued from page 97*)

imagination of the industry. Displays constantly grow bigger, more colorful, and more dramatic.

Einson-Freeman Co., Long Island City, N.Y., turns out a liquor window display about 3 ft. high and attractively preprinted from a 32- by 40-in. sheet of 0.020-in. vinyl. The draw on this piece goes as deep as 5 inches.

Pearson-Berlinghof Inc., Newtown, Pa., makes a promotional display consisting of a formed butyrate mermaid, some 50 in. long, with an internally illuminated formed transparent "diamond" in her hand.

Also of butyrate, supplied by Eastman Chemical Products, Inc., is a white self-service ice cream display sign vacuum formed by Vacuum Molding Inc., Boonton, N.Y., and assembled in a steel frame. Raised letters at the top of the sign are formed in.

Metallized plastic sheet is finding extensive use in vacuum forming. Such material was used by Vacu-Form Corp. of America to produce a formed coffee pot display for General Electric Co. To make the unit as realistic as possible, an elastomeric mold was produced directly from the coffee pot itself and an epoxy production mold was cast in the elastomeric mold. Because a silver-metallized sheet was used, neither preprinting nor post-decorating by spraying was necessary on the body of the pot. Only the handle and base of the pot had to be painted brown.

Toys and Novelties

To list the many variations in the toy and novelty field that vacuum forming makes possible would require volumes—and the toy industry still feels that the surface has only been scratched.

In dolls, alone, practically every producer in the country has added a vacuum formed doll face to his line. Bassons Industries Corp., Bronx, New York, forms such a doll face and reports that faster production rates and perfected techniques are expected to expand this market considerably in the next few years.

Flexite Plastic Novelty Co., New York, N.Y., another supplier of doll faces, began switching to vacuum

Don't be a Slave to High Production Costs

Vacuum Forming

by **MAJESTIC**

A leader and pioneer in this low-cost production technique

The economy of 3-dimensional vacuum forming as a method for producing industrial parts, package components, displays and other items makes it possible to use plastics where they never could be used before. Majestic Creations is set to assist and serve all potential users. We offer . . .

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Plenty of production—Majestic can supply whatever volume you need. Our automatic vacuum forming equipment makes items as large as refrigerator door panels right on down to small, shaped-to-product packages.

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THE APEX CYLINDER PRINTER
MODEL C-31 FOR 1 COLOR

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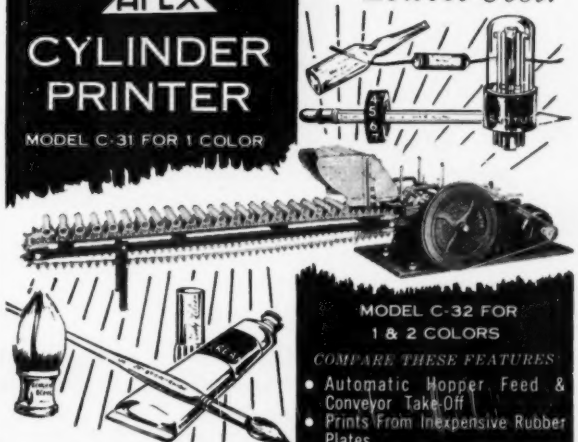

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- Prints One Or More Lines At The Same Time On A Portion Of, Or Completely Around Tube
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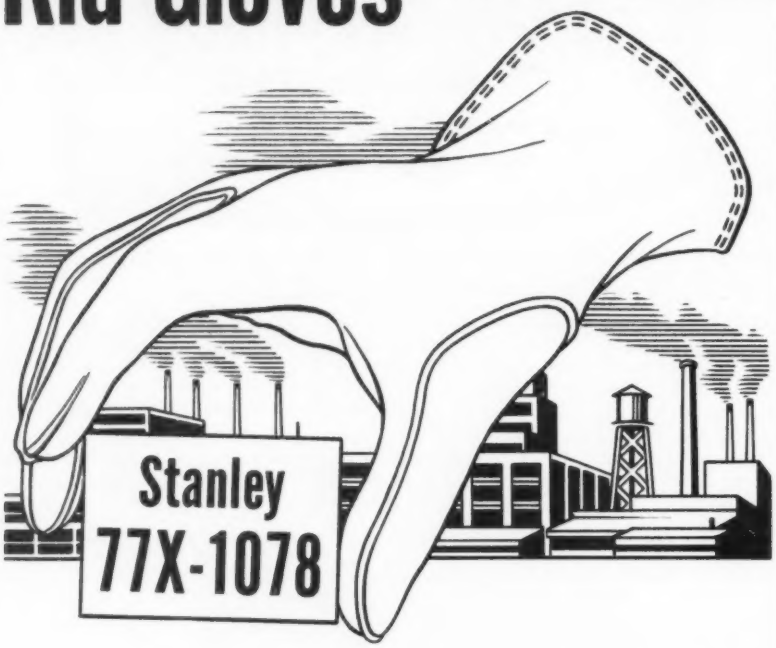

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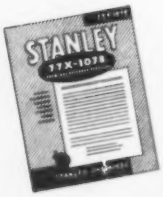
When materials handling means handling with care it will pay you to see that your racks, tote baskets, or other metal containers are coated with Stanley 77X-1078, the resilient orange plastisol that safeguards your product from damage. In cleaning and finishing operations the high resistance of 77X-1078, to inorganic acids, salts, and alkalis, to organic materials — particularly trichlorethylene and perchlorethylene — and to most plating solutions, is your assurance of surface protection that lasts. And the surface of 77X-1078 is just hard and slick enough to promote rapid drain-off and to minimize carry-over. The new Stanley bulletin shown below contains full details about application of 77X-1078 and the test results that proved its chemical resistance. Copies are available on request.



Write today for the new bulletin on 77X-1078 to the Stanley Chemical Company, 71 Berlin Street, East Berlin, Connecticut.

PLASTISOLS
ORGANOSOLS
VINYL INKS

STANLEY CHEMICAL

forming about two years ago; nearly all its faces are now made by the process. Currently these faces are being formed of Royalite styrene copolymer sheet in a 45-cavity mold at a rate of one sheet per minute.

Plaques

Another toy trend particularly noticeable in the past few months has been the increase in vacuum formed three-dimensional uncolored plaques that can be painted in water colors by the child, wiped clean, and reused as often as desired.

Pancordion Inc., New York, N.Y., introduced such a painting kit containing four formed acetate plaques several months ago[2] and has added two more items to its line—a formed dog or cat plaque and a formed wall plaque of Walt Disney characters. The items are formed of opaque white acetate and the kits include brushes and paints.

A similar application is a paint-puzzle set being marketed by Plas-Trix, New York, N.Y. The set consists of a cardboard sheet printed with a scene from a popular nursery rhyme, and an opaque white styrene sheet formed with parts that correspond to various elements in the scene. These elements, such as dogs, cats, trees, or figures, can be removed by the child from the cardboard sheet—they are die cut to facilitate removal—and replaced by the corresponding three-dimensional part. After the formed parts have been painted, the child has an attractive three-dimensional wall plaque.

A deep water well and smaller depressions which accommodate the paints are also formed into the styrene sheet. At the same time, a small round projection is formed in which a hole is punched to accommodate the paint brush.

A novel three-dimensional mobile is being vacuum formed by The Emeloid Co., Inc., Hillside, N.J., for the Jolly Blinker Co., New York, N.Y. The set consists of a formed plaque depicting a character from a children's TV show and two sheets formed with smaller three-dimensional figures of other characters on the show. When the figures are assembled and the plaque is hung on the wall, an acetate rod is inserted

[2] "Plastics Products," Modern Plastics 30, 106, (Aug. 1953).

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Plastics

requiring *immediate factory space*, in units of any size, and *skilled experienced workers* for branch operations, are urged to investigate the specialized facilities in

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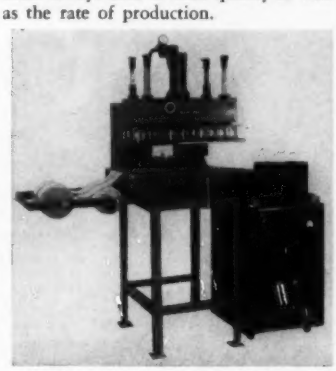
A standard Mayflower press has 18"x30" flat bed; powered by Mayflower 3½kw. generator. Accurate and highly productive in a widely diversified application of tear sealing.



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A constant volume of air at a controlled temperature in the heavily insulated cabinet, maintains uniform predetermined specimen temperatures regardless of variations in room conditions.

Automatic control of humidities up to dew point is available as optional equipment.

All automatic controls including complete voltage controls are located on the front panel of the Weather-Ometer directly above the door of the test chamber.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid materials and vertical panels for solid materials.

Source of radiation is two Atlas enclosed violet carbon arcs.

Complete technical information on the DMC model and other Weather-Ometers is contained in the new Weather-Ometer catalog. A copy will be mailed on request.

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Order TODAY. Price $97.50 F.O.B., Clinton, Mo. (Includes Motor bracket, V-belt, motor pulley, less motor).

For light work—stamping, forming, riveting, etc.—metal, fiber or other material.

Overall height 17½" . . . Base size 8½"x8½" . . . Die bed 5½"x8½" . . . Ram face 1½"x 3½" . . Ram stroke ¾" . . . positive ¾" ram adjustment . . . sturdy, single pin, non-repeat hand lever clutch . . . V-belt drive . . . weight 105 lbs.

Requires only ¼ to ⅓ H.P. motor.

The machine of a thousand uses! Adequate for many types of work now done on large presses at greater expense.

ALVA F. ALLEN, *Dept. MP*, CLINTON, MO.

in a hole in the plaque and the figures are suspended from it by wire and string.

Both plaque and figures are vacuum formed from preprinted or lithographed sheets of 0.010-in. vinyl using molds cast from epoxy resin supplied by Shell Chemical Co. The molds were made by Ber-Design Corp., Newark, N.J.

A miniature planetarium being marketed by Harmonic Reed Corp., Rosemont, Pa., is made up of a vacuum formed globe mounted on a molded styrene stand. A light within the ball shines through holes to project "stars" on the ceiling and sides of the room.

The globe is vacuum formed in two halves, each 3½ in. deep, by Pearson-Berlinghof Inc., using a clear butyrate sheet. Twenty-one halves are formed at a time and then die cut prior to assembly and mounting. The globes are spray painted on the inside to simulate the color of the sky.

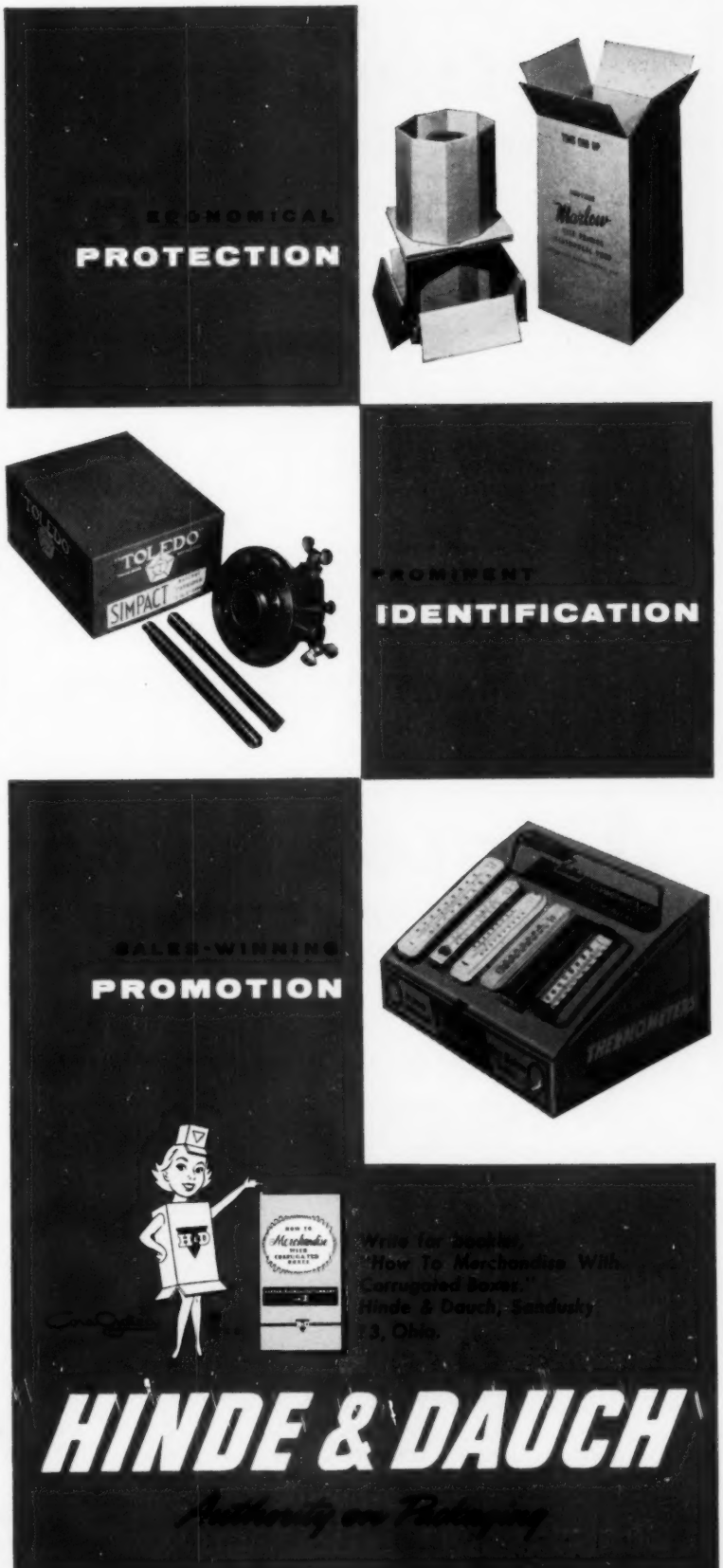
Cortland Industries, Chicago, Ill., vacuum forms another type of educational toy for Illuminated Plastics Co., New Holstein, Wis. Using Campco S-300 sheet, a deep tray standing on four hollow legs is formed in one piece. A 110-v. bulb is mounted in the base of the tray and a sheet of translucent Campco is inserted on top of the tray.

To use the unit as a tracing set, the child simply places drawing and tracing paper on top of the translucent sheet and switches on the light. The light provides a uniform diffused glow over the entire tracing surface. Rotating clips that hold the drawing in place are also formed from Campco sheet and are attached by rivets.

Appliances

To quote one manufacturer: "The appliance field is the greatest of all vacuum forming fields." Within the next few months, millions of pounds of plastics materials will be absorbed by this field. Modified styrene sheet from 0.050 to 0.125 in. thick will make up the bulk of this poundage in the form of liners, trays, covers, and housings for refrigerators, washing machines, ironers, and similar appliances.

Of these applications, refrigerator door liners weighing up to 8 lb. are probably the most important. One leading manufacturer in the refrig-



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for your LARGEST requirements

New automatic equipment permits Gregstrom to custom manufacture — dimensions up to 48″ x 84″ — draws up to 24″ deep . . .

Equipped with one of the largest, most efficient, fully automatic drape, draw, vacuum forming machines in existence, Gregstrom can meet production requirements formerly beyond the scope of this young manufacturing method.

Gregstrom, with their battery of machines, easily forms most of the largest commercially available plastic sheets—creating, in a fraction of a minute and with minimum die cost, articles running in size from the largest of signs and displays, through refrigerator inner door liners, tanks, trays, etc., down to thin gauge packaging of the capsule type. Naturally, with this new, large equipment, Gregstrom can show substantial reduction in cost on multiple-die, vacuum-formed items.

DESIGN, ENGINEERING, FABRICATION, AND FINISHING services are all available at Gregstrom. Equipped to preprint by silk screen methods, Gregstrom can form, fabricate, trim, assemble, finish, pack, and drop ship to your requirements—providing you with a completely finished product at a low cost. Write today or phone us at UNiversity 4-6440.

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PRINTING MACHINE FOR VINYL AND POLYETHYLENE FILMS

- **Handwheel or motor controlled register units assuring accurate register at all speeds**
- **No exposed gearing**
- **Repeats in patterns from 14″ to 72″ and larger upon request**

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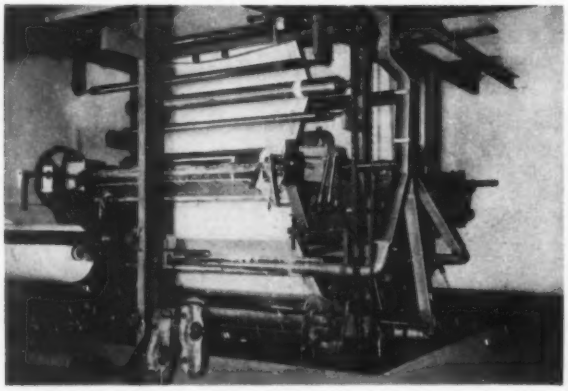

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Manufacturers of Printing Presses and Cylinders

eration field estimates that his company alone will use over 2 million lb. of plastics for this application in 1954.

A great deal of experimentation has been done on the use of heavy-gage materials—in the 1/8- to 3/16-in. category—for the fronts, doors, and sides of air conditioning units. According to Auto-Vac Co., Fairfield, N.J., the technique of forming heavy material is not difficult. Most of these pieces can be formed by the drape method, using male molds of plaster or aluminum. Water cooling of the molds is necessary, as well as external air or water fog cooling of the top of the part to reduce the length of molding cycles.

Vacuum formed masks for television picture tubes have practically taken over this field because of the economy of vacuum forming, because of the thin wall sections of the mask, and because style changes in TV design demand a flexible production method. Curbell, Inc., Buffalo, N.Y., vacuum forms TV masks from general-purpose styrene and Royalite and Boltaron copolymer sheets.

An improved type of reflector housing is used in Sylvania's new Halolight television mask assembly. Formed by Cortland Industries from styrene copolymer sheet supplied by Chicago Molded Products Corp., Campco Div., Chicago, Ill., the housing is an integral part of Sylvania's system of framing the TV picture tube with soft light to make viewing easier on the eyes. A depression for the neon tube, complete with access hole, is formed at the same time the deep-drawn reflector is produced.

In the realm of kitchen accessories, where vacuum forming is expected to find wide future use, one present application is an attractive silverware tray formed by Nalle Plastics, Inc., Austin, Tex., using extruded sheet made from Lustrex Hi-Test 88 styrene supplied by Monsanto Chemical Co. Because of the thin wall sections required in the design of the tray, vacuum forming has proved to be an ideal manufacturing process.

A food tray designed for use by commercial airlines has been vacuum formed by Northern Industrial Chemical Co., Boston, Mass., from a 3/32 in. thick sheet of Boltaron styrene copolymer. To keep cups, dishes,

and utensils in place while the plane is in flight, contoured depressions are formed into each tray.

An application for vacuum forming which is taking on more and more importance is the manufacture of tote boxes for materials handling. Such companies as Bassons Industries Corp., Durable Formed Products, New York, N.Y., Jered Engineering & Mfg. Co., Chicago, Ill., and Product Engineering Laboratories Co., Inc., Newark, N.J., have developed materials handling into a science based largely on the special advantages offered by tote trays and boxes produced by vacuum forming.

By forming tote tray bottoms with depressions shaped to the contour of the parts to be handled, even delicate electronic instruments can be handled without fear of breakage.

In the lighting field, ceiling panels of vinyl, styrene, or acrylic are making a name for themselves and decorative formed laminate bowls for indirect lighting are finding wide application.

Vacuum formed parts for lighting fixtures are also being put to excellent use by Lam Workshop, Inc., Boston, Mass. A diffuser shade, for example, is being vacuum formed in one piece of oriented styrene. The diffuser is formed in a single-cavity sprayed metal mold in a 2-min. cycle. The base of the lamp is vacuum formed of Boltaron styrene copolymer sheet.

In deciding to install a vacuum forming set-up on the production line, Lam Workshop was influenced by the fact that most of its jobs are small quantity runs on a custom basis.

Specialized Uses

As illustrated by a case study from Vacu-Form Corp. of America, there are many specialized applications to which the vacuum forming process can be applied. Recordak, Inc., a subsidiary of Eastman Kodak Co., contracted with Vacu-Form for the production of a sheet styrene platen tray for the Recordak Rapid Facsimile Kit which is used by banks, stores, etc., to develop microfilm.

The platen tray had to be designed to accommodate all the equipment—sponges, squeegees, etc. —necessary for the developing process. It had to be light in weight and resistant to chemicals; it also had to

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PROPER APPLICATION...PRODUCT IMPROVEMENT

hold accessories in place while the developing operation took place.

Before deciding on the vacuum forming process, Recordak, Inc., had investigated several other methods, but since volume was small and the tray was rather large—18 by 19 in.—vacuum forming won out. The material used was 0.060-styrene sheet.

A model was prepared and, after a few minor corrections, the production mold was completed in less than eight working days. Within four work weeks after the order was placed, the trays and kits, assembled and packaged, were delivered to Recordak at a cost well within the specified limits.

As applications of vacuum forming spread into many different fields, the need for bigger vacuum forming machines becomes more and more obvious. Today, machines with 30-sq. ft. platens capable of forming 25-lb. parts are common. Currently being designed are machines with 51-sq. ft. platen areas which can handle 31-lb. parts.

For tomorrow, there is talk of a 100-sq. ft. platen area machine which can turn out 60-lb. parts.

Bigger Machines

There seems to be no limit to the size to which a vacuum forming machine can go. As larger extruded sheets become available and as costs of material go down, some of the things that can be expected are machine housings, appliance cabinets, and huge full-size outdoor posters, preprinted and formed in one piece. There is talk of forming complete structural shapes and automobile panels—even boat hulls—from plastics sheets, once a material with sufficient abrasion resistance is here.

One of the most important objectives of the vacuum forming industry is the perfection of methods for high-speed mass production.

Toward this end, Federal Tool Corp., Chicago, Ill., has developed an economical set-up for producing picnic plates from extruded styrene copolymer sheet.[8] As the sheet emerges from the extruder—and is still hot enough to be formed—it is formed in a single-cavity die. The formed sheet then passes to a punch press which cuts the individual plates.

In an automatic sheet forming set-

[8] "Picnic Plates Vacuum Formed," Modern Plastics *29*, 92 (Aug. 1952).

up developed by Plaxall Inc., Long Island City, N.Y., acetate sheet is fed from a roll by chain conveyor through all the forming operations.[4] As the cooling cycle approaches completion, a cutting edge engineered to the shape of the piece is forced against the sheet stock, scoring the material so that the pieces can be easily snapped out of the web.

Better Materials

The future of vacuum forming becomes even brighter as improved extruded, calendered, and cast plastics sheet are developed. Each of the companies listed in the chart between pp. 90 and 91 is constantly working on such improvements.

A great deal of this research has been directed towards extruding sheet with a better surface finish. Auburn Button Works, Inc., for example, has perfected a technique for producing a glazed surface finish on its extruded sheet. In addition, Chicago Molded Products, Campco Div., is now offering its styrene alloy sheet with an integral high-gloss surface finish that resembles porcelain enamel.

It is probable that as such enamel-like sheets are made available to the vacuum forming industry, formed parts may replace porcelainized sheet steel for the outer panels on such appliances as refrigerators, freezers, and washers.

One other development in vacuum formable sheet materials, produced by The Goodyear Tire and Rubber Co. Inc., Akron, Ohio, is a styrene copolymer sheet that contains no rubber but has extremely high-impact strength.

There are still new fields for vacuum forming, more applications to which it can be put, more production set-ups to which it can be adapted. It seems certain that the majority of molders and fabricators in the plastics industry will eventually supplement their present operations by installing vacuum forming equipment to meet the demands of a growing number of customers.

The vacuum forming industry can look back with pride on the accomplishments in the past five years and can look forward with optimistic anticipation to the possibilities which the future holds.—END.

[4] "Automatic Sheet Forming," Modern Plastics 30, 106 (July 1953).

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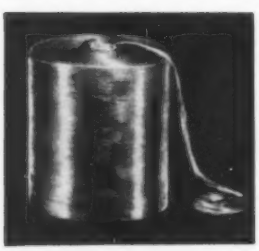

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Peak Performance

(*Continued from p. 99*)

hundred thousand molded nylon units made for the Royal-T and other hearing aids.

The complex cores, bosses, and other design features of the Royal-T chassis provide attachment and mounting for internal components of the instrument. Except for the side cores, which are drilled by Zenith, all these blind and through openings are produced in the molding process. Three small sponge rubber pads are cemented in place in the chassis to "float" the microphone and eliminate the transmission of noise from the outer case. Many of the functional parts which mount to the chassis are concealed by means of a cover formed of black cellulose acetate sheet, on which are silk-screened the Royal-T trademark and warning instructions cautioning against removal of the cover. It is held in place by three small screws which penetrate cored bosses in the chassis and permit easy removal of the cover for servicing.

Coil Forms

The two transformer coil forms in the Royal-T are injection molded of nylon. The material is favored for this application because its high temperature resistance withstands a dip into a heated thermoplastic sealing solution after the wire has been wound on the coil forms and the laminations installed.

The volume control and the tone control base, having approximately the same dimensions, are molded of black phenolic, while the matching volume and tone control knobs are of black acrylic. One supplier of the latter two parts is producing them by means of a double-shot injection molding technique through which the calibrations, in a contrasting color, are molded-in; parts supplied by another molder have the calibrations hot-stamped in gold.

The phone magnet cover of the Royal-T is molded of clear transparent acrylic, with the lettering and telephone symbol debossed in the under side and sprayed in gold for a three-dimensional effect. This part constitutes a decorative shield for the induction type pickup, used

when the wearer wishes to amplify a telephone conversation. It is held in place by means of synthetic rubber cement. A spacer block molded of high-impact styrene supplied with the instrument is inserted in the case when two short batteries instead of one long battery are used, for the Super-Royal version. This arrangement permits the use of the same case for both models.

The three transistor sockets, each having tiny molded-in metal inserts, are transfer molded of phenolic material, as is the external microphone socket. This part snaps in position along one side of the chassis, with its extended cored boss fitting a drilled opening in the nylon material. It provides an optional phone jack outlet for use with an exterior microphone.

Ear-Piece Components

The largest of the ear-piece components is the acrylic housing, molded of flesh tinted material. Also included in this part of the instrument are two small styrene coil forms, only 5/16 in. long, an air-seal washer stamped from thin vinyl film, and two small pieces stamped from phenolic laminate which support the contact springs.

The standard ear mold supplied with the instrument, produced in clear transparent acrylic material, has a press-fitted metal insert into which the ear-piece fits. The part must be non-toxic to the human skin, free of scratches, gate marks, air holes, and crazing, and outer edges must have a smooth, polished surface without any sharp edges.

The braided earphone cord, consisting of two strands of wire with a flesh-colored vinyl covering, has a plug molded of clear cellulose acetate butyrate at each end in which the metal contact prongs are embedded. A short length of vinyl tubing locked into the butyrate plug is used at each end of the cord for additional protection and strain-relief when connections are made or broken. The assembly must withstand a minimum pull of 10 lb. on cord and contact pins.

A printed die-cut sheet of clear hard vinyl carries a simple diagram and instructions showing how batteries are to be inserted. This sheet, printed in gold on the underside to protect the printing against wear, and with a black background, is secured to the inside of the aluminum case by means of double-coated pressure-sensitive tape.

Also supplied with the Royal-T hearing aid is a strap-type fastener which includes a metal pin and clasp. Fabricated of vinyl sheet and tubing, it is used when the wearer wishes to fasten the instrument to the clothing by slipping a button through the die-cut slot in the strap.

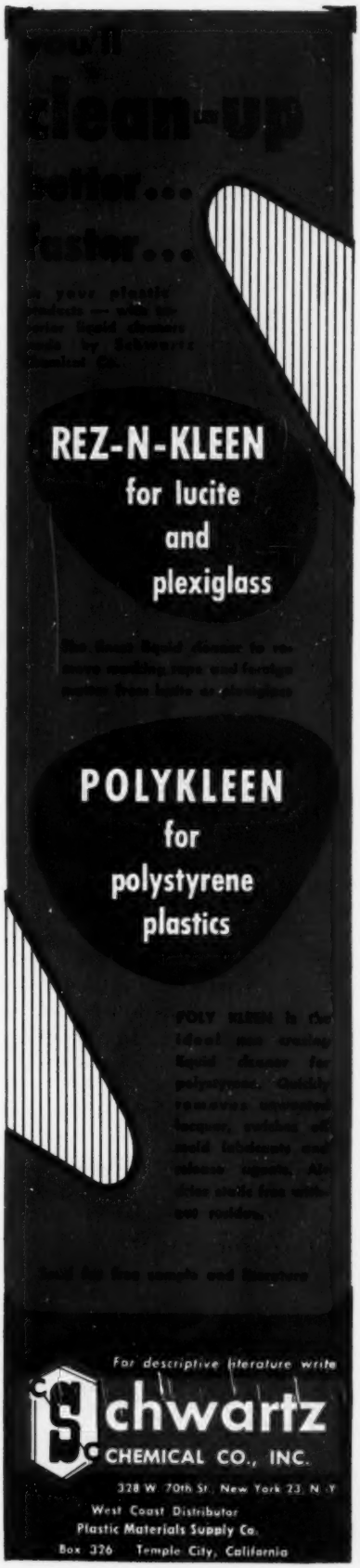
CREDITS: Nylon chassis, acrylic tone and volume control knobs, tone control base, acrylic phone magnet cover, styrene battery spacer block, acrylic earphone housing, and nylon transformer coil forms by Peerless Molded Plastics, Inc., Toledo, Ohio. Nylon tranformer coil forms also supplied by Evans-Winter-Hebb, Inc., Detroit, Mich. Two-shot acrylic volume and tone control knobs by Gits Molding Corp., Chicago, Ill. Phenolic volume control by Centralab Div., Globe Union, Inc., Milwaukee, Wis. Phenolic transistor sockets, external microphone sockets, and cellulose acetate butyrate earphone cord plugs by Plastic Mold and Engineering, Providence, R.I. Styrene earphone coil forms by Santay Corp., Chicago, Ill. Acetate sheet amplifier cover by G. Felsenthal and Sons, Inc., Chicago, Ill. Printed vinyl battery insulating strip by Parisian Novelty Co., Chicago, Ill. Acrylic stock earmold by Superear Products, Lynbrook, N. Y. Synthetic rubber cement by Minnesota Mining and Mfg. Co., St. Paul, Minn.

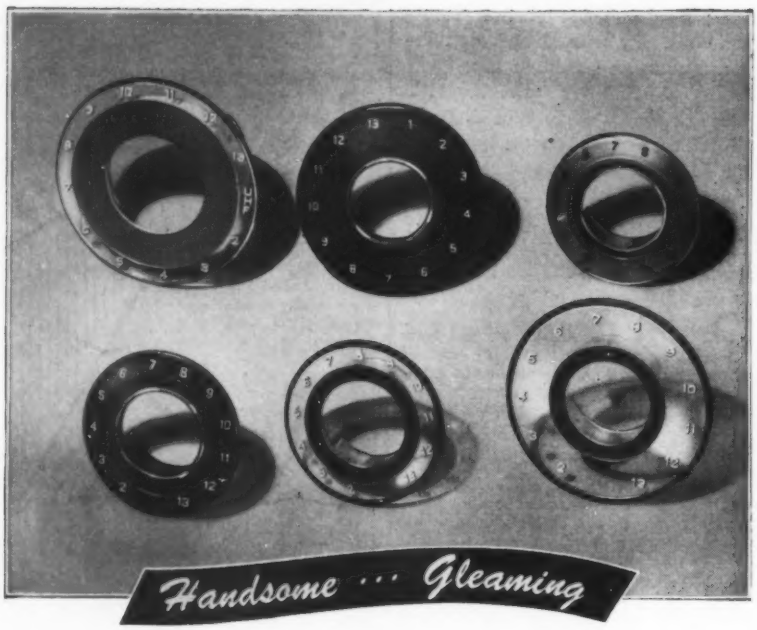
Phenolic Hood

(*Continued from p. 101*)

cord is first fed through the opening near the top of the hood and electrical connections made. Next, the complete internal assembly, including the heating element, motor and fan, and a perforated metal baffle which directs the flow of warm air, is placed in position with the two bolts protruding through the top of the hood. Finally the clamp hanger is slipped over the bolts and the nuts applied. A molded phenolic strain relief collar, made in two interlocking parts, is placed around the cord and forced into place in the cord opening with a special compression tool. Pressure of the cord causes the collar to spread slightly, locking it in place by means of a molded groove in the side. This collar grips the cord so securely that the full 3½-lb. weight of the dryer may be supported by the cord without placing any strain on the internal connections.

CREDITS: Phenolic hood molded by P. R. Mallory Plastics, Inc., Chicago, Ill., using Durez general-purpose phenolic material.





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'Popcorn' Plastic

(*Continued from p.* 105)

lysts, the price of various plastics foams may run from 1¢ to $13.75 a board foot, depending upon the type of material used.

There are many other possible applications than insulation for the new polystyrene foam. Its toughness, mechanical strength, and light weight suggest use in construction panels where the outside skins may be wood, fiberboard, laminated plastics, and various metals. It can be easily adhered or glued to most any other material. It remains dimensionally stable with changes in humidity, contrary to the behavior of wood, because of low water absorption. Low thermal conductivity also imparts insulation ability to panels containing it. Thus, a combination of versatile properties makes it highly suitable for application in a variety of fields.

In Flotation Gear

Perhaps the most sensational possibility for the future would be this foam's use as a float or to provide buoyancy for boats, rafts, buoys, and other marine equipment. Compartments can be completely filled by molding *in situ.* Because of its low water absorption, buoyant properties are retained after prolonged immersion. Its buoyancy is such that 1 cu. ft. of comparatively low density will support approximately 60 lb. of weight. To put it another way, 1¾ oz. will hold up more than 2 lb. of weight. The foam may some day be widely used in floats for moving heavy equipment across rivers or wherever raft-like flotation units are needed to accomplish a job efficiently and economically.

Numerous other possibilities are suggested. Toys, novelties, and displays can be molded from this material without the need for pressing or cutting to shape. It can be used as a sound barrier, but not for acoustical tile. It can be used with other materials as a filler and bonding agent in insulation or sandwich construction.

Only the imagination of prospective users and experience in applying it are needed to turn this new material into another plastics jack-of-all trades that could mean big volume utilization in numerous industrial and consumer fields.—END

Thickness Gage

(*Continued from page* 124)

ness; 2) average thickness lengthwise along the thinnest side—average of minimum octant; 3) average cross-sectional thickness—average of octant averages; and 4) maximum difference between the lengthwise average of the thickest side—average of maximum octant—and lengthwise average of the thinnest side—average of minimum octant.

Conclusions

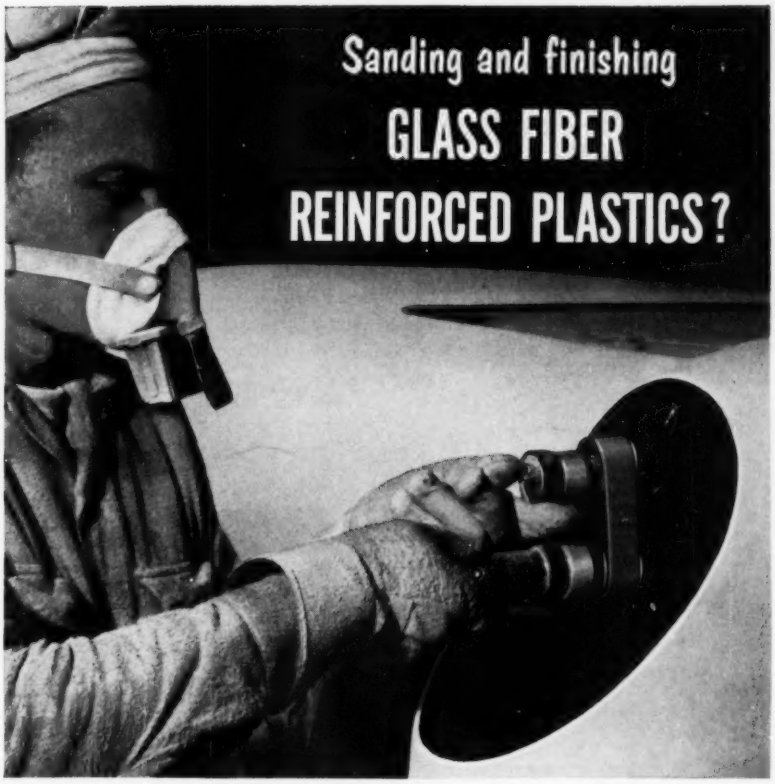
This test equipment has proved to be a practical means for the control of concentricity and average thickness of the polyethylene sheath on Alpeth and Stalpeth cables. It is accurate, reliable, and of rigid construction suitable for continuous shop use. It measures the sheath wall thickness directly in thousandths of an inch both visually and as a recorded graph and does so non-destructively as the sheath is applied.

Concentricity is maintained within 35% on Alpeth and within 20% on Stalpeth cable. Average thickness is controlled to within ± 0.005 in. of specified average thickness by the practice of visually averaging graphs of about 25 ft. of cable length.

Polyethylene is conserved in two ways which reduce manufacturing costs. First, improved control permits operating at specified average thickness without going below minimum spot limit. Previously, an excess over specified average thickness was necessary to prevent the wider range of variation from going below the specified minimum spot thickness. Second, the sheath is of consistently uniform dimensional quality not previously obtainable which made it practical to reduce the average wall thickness 11% below the thickness which had been specified earlier.

Acknowledgements

The writer wishes to express his appreciation for the co-operation of B. M. Wojciechowski of Western Electric Co., who developed the capacitance test set, and of the Bell Laboratory cable engineers in establishing the sheath requirements and for their encouragements in this project.—END



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Silicone Foams

(*Continued from p.* 141)

mined to be between 700 and 800° F. Silicone foams made from either resin show only a slight surface decomposition when exposed to the direct flame of a Bunsen burner or a blow torch for 2 to 3 min., even though the most affected area will glow red-hot (Fig. 11). Other foams, said to be self-extinguishing, either charred beyond recognition or burned completely under the same treatment. Figure 12 compares the heat resistance of the presently available plastic foams.

The foams also have excellent thermal insulating properties (Fig. 13). For a density of 11 lb./cu. ft., a thermal conductivity of 0.3 B.T.U./hr./in./sq.ft./°F. was obtained. This value is comparable to that of expanded polystyrene having a density of 2 lb./cu. foot. Additional tests on lower-density silicone foams are currently being conducted.

The closed-cell structure of silicone foams is shown by the fact that a sample immersed in an ink solution under 31 in. head for 300 hr. showed no discoloration below the outer layer of cells. Water absorption for this sample was determined to be 5.2% by volume. Other samples, exposed for 7 days at 96% relative humidity, showed a weight increase of only 0.032 percent.

Data on the electrical properties of XR-544 foams are presented in Table II. These values are the results of tests conducted at Wright-Patterson Air Force Base. It is possible to extrapolate the variation in dielectric constant with density in either direction without serious error.

Because silicone foam has been introduced to the market only recently, its field of useful applications has not been thoroughly explored. Its excellent heat resistance and low thermal conductivity suggests a broad potential in thermal insulation. Its flame resistance may be utilized in firewall bulkheads. At present, however, principal interest in silicone foam centers about its possible use as a foamed-in-place sandwich core for aircraft and guided missiles. Its high strength-to-density ratio and good electrical properties, for instance, may be used effectively in radomes.—END

Insulator Design

(*Continued from p. 142*)

thickness when tested in oil, using a short-time rate of rise of 500 v./sec. according to A.S.T.M. D 149-44. In general, Melmac 1502 appears to be of better dielectric quality than Compounds A and B. An expression

$$V = 10^4 d^{0.385}$$

has been derived for it which relates V, the short-time (500 v./sec. rise) breakdown potential expressed in volts, to "d", the specimen thickness in mils. A similar expression

$$V_m = 10^4 d^{-0.685}$$

where the dielectric strength V_m is expressed in v./mil (V per unit thickness) shows that the breakdown potential per unit thickness decreases as the thickness of the material is increased, a relation which is common to most insulating materials regardless of the test method employed. Similar expressions can be derived for the other materials studied.

Long-Time Tests

Endurance data were obtained by applying potentials equivalent to 40, 50, 60, and 75% of short-time breakdown until either failure occurred or the specimen sustained a particular stress for 100 hours. This period of time appeared to be equivalent, for all practical purposes, to indefinitely longer ("infinite") periods of test duration.

The geometric average of results obtained on five specimens tested per thickness was taken because of the variability and scatter of the endurance data. Peek's Law

$$V = V_o + aT^{-1/4}$$

where V is the breakdown potential at any chosen time, V_o is the breakdown potential after "infinite" time of application, "a" is a constant of the material, and T is time, was used to obtain V_o for the materials studied. The limits within which the values for V would lie with a probability of 0.9 were used to calculate the limits for the corresponding values of V_o. The supposition that V_o has the same limits appeared to be warranted by the data obtained when stresses that approached the V_o value were applied for 100 hr. and did not cause failure. For the ranges tested the empirical data obtained agreed with Peek's Law within 2 to 8% for Melmac 1502, 2 to 12% for

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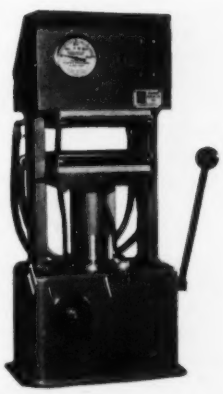

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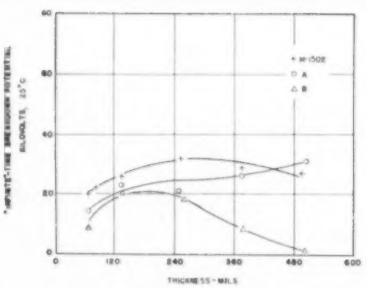


Fig. 4—"Infinite"-time breakdown potential versus thickness of specimens

Compound A, and 2 to 9% for Compound B.

When infinite-time breakdown potential is plotted as a function of thickness, as shown in Fig. 4, the characteristics of the curves obtained can be seen to differ from those for the short-time tests in Fig. 3. The melamine materials are comparable in behavior, whereas Compound B, the general-purpose phenolic material, is significantly inferior over the thickness range tested. For Melmac 1502 the curve of V_0 shows a maximum at a thickness of approximately ¼ in., whereas in the short-time test, an apparent maximum has not been reached up to a ½ in. thick section. This suggests either a limitation in molding quality versus thickness, or that breakdown is largely thermally instigated. When long term stresses are applied, a critical thickness may be reached at which the material is not capable of dissipating heat at a rate fast enough to offset the release of charged carriers by thermal agitation.

Temperature Effects

The data for the curves shown in Fig. 5, in which the effect of temperature is shown, were calculated in the same manner as those in Fig. 4. The agreement with Peek's Law was within 10 to 15% for Melmac® 1502 and 2% for Compounds A and B. The values and limits of V_0 for Melmac 1502 and Compound A were comparable up to the 60° C. range. At 100° C., however, long-time stress appears to have a pronounced deleterious effect on Compound A such that its fatigue ratio, i.e., "infinite" time breakdown value calculated as percentages of the corresponding short-time breakdown value, drops to 3%, whereas that of Melmac 1502 has dropped only to 43%. This weakness of Compound A would not have been adduced if Compound A were judged only on the basis of short-time tests at 100° C., where it was slightly better than Melmac 1502.

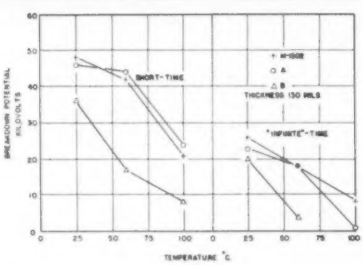
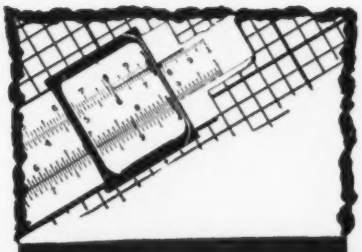


Fig. 5—Breakdown potential vs temperature

Discussion of Results

The data obtained here confirm in general the results of similar work published by Telfair and Schuster.[2] They were of the opinion that the electric breakdown strength of materials is associated to a great degree with the fact that an alternating field generates heat within a material in

[2] "Dielectric Fatigue of Plastics," W. W. Shuster and D. Telfair, Modern Plastics. *25*, 123 (Mar. 1948).



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accordance with the principles of dielectric heating. The rate of heat production is usually expressed as

$$P = CV^2\omega K \tan \Delta$$

where V is the applied voltage, ω is 2π times the frequency, K tan Δ is the loss factor of the material, and C is a proportionality factor that includes form factors. According to this assumption, for the application of a given voltage the rate of temperature rise in the material would decrease with time as greater quantities of heat are lost to the surroundings, until an equilibrium point is reached where the rate at which heat is lost is equal to the rate of internal heat production. Greater thermal agitation (on a molecular scale) at this higher equilibrium temperature facilitates the release and acceleration of ions or other charge carriers in sufficient quantities to initiate the "charge avalanche" of breakdown.

Although dielectric heating certainly is an important factor in dielectric fatigue, it cannot explain certain facts. Polystyrene, for example, exhibits about the same ratio of fatigue to short-time strength as do other materials with much higher loss factors. The rate of heat production in polystyrene should be only about one-hundredth as great as that of Melmac 1502 and Compound A. For the above theory to hold, one would then have to show that polystyrene is 100 times as sensitive to temperature.

Any explanation of the anomalous behavior of the dielectric fatigue of insulating materials is beclouded by the presence of small traces of ionic materials and any small scale voids or discontinuities that may be present. These factors probably have more pronounced effects on low loss materials like polystyrene, but must also be considered for higher loss materials.

The test procedures used in this investigation did not overcome all of the limitations imposed by standard dielectric strength tests such as short-time and step-by-step methods. The data obtained in endurance tests, however, should prove useful for the design of insulating components for electrical equipment. Although the relationships derived are only approximate, they can be used with better reliability for predicting behavior than present methods.—END

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Mylar Polyester Film Soon to be Available in Quantity

NEW uses for Mylar polyester film are popping up in all sorts of places as users gain experience in handling it and as they find that considerably more of the film is available than could be had a year ago. Officials of Du Pont, which produces the film, state that, although volume is limited by the production available from a semi-works plant, there is still a substantial amount on hand —probably 100% more than was being produced in September 1953. Those interested are invited to make inquiry for experimental or developmental lots.

A new plant at Circleville, Ohio, is scheduled to come into production in July and should be able to supply all needs for some time to come. A processor who develops a new end use now should, therefore, have no difficulty in obtaining all the Mylar he may need by the time his project is ready for the market.

Mylar polyester film is made from polyethylene terephthalate—the polymer formed by the condensation reaction between ethylene glycol and terephthalic acid. In addition to toughness, durability, impermeability to many gases, and extraordinary electrical properties, it is particularly noted for its retention of flexibility and stability over a temperature range from —60 to 150° C. (—76 to 302° F.).

Three Types—The film is currently available in a number of gages and in three distinct types, each of which is basically the same. The types differ only in that minor modifications have been made so as to adapt the film to a greater variety of end uses.

Type A is a film with low fault count (a measure of pinholes or spots of dielectric weakness) for insulation and dielectric material. It has many non-electrical applications where strength is important and freedom from static is not essential. The thin gages, 25 to 50, are transparent; the heavy gages such as 500 to 750 are somewhat hazy.

Type C is primarily intended as a dielectric in high-temperature capacitors.

Type D is a highly transparent film with a minimum of surface defects, recommended for glazing and glass replacement applications.

The film is produced from the same raw materials as Dacron polyester fiber in this country or Terylene in Great Britain. Another similar material is Du Pont's polyester photographic film base which will be used in lithographic film and motion picture film.

No Plasticizer—Mylar has already been discussed in these columns as a material suitable for electrical and industrial tapes, such as sound recording and control tapes for electronic computing machines, because of its tear resistance, dimensional stability, and the fact that it contains no plasticizer and so will not dry out and became brittle with age. Another type of Mylar tape is being used as a substitute for steel strapping.

Mylar is also suggested as a glazing material for storm windows and poultry houses. Compared to cellophane and window glass it falls midway between the two in transmitting light, but cuts off ultra-violet to about the same extent as window glass.

Acoustical tile is now being covered with Mylar printed in an attractive design. The same film can also be laminated to fibrous glass insulation, thus preventing water from condensing inside the insulation material and also providing a printed, decorative surface that can be washed and that will provide brilliant color for years.

Decorative laminates are another new application for Mylar. Reverse printed film simulating wood grain can be laminated to paper or low-cost plywood. A 2 to 7 mil thick film on top of plywood would cost less than conventional decorative laminates, but is recommended for cardtable tops and vertical surfaces rather than kitchen equipment. It can also be laminated to vinyl film or sheet and thus combine the properties of the two materials.

With Metal—Considerable study is being given to the use of Mylar with metal. A thin layer of aluminum may be deposited on Mylar by a vacuum process and the resulting mirror-like film may be laminated to a fabric backing and embossed to form a decorative material for such uses as upholstery, shoes, pocketbooks, and window shades. The metallized film can also be laminated to steel as well as fabric. The fabric-backed, aluminized Mylar has already been tried on one automobile in place of chrome trim with promising results. One pound of ¼-mil thickness will cover 80,000 sq. in. or 60 sq. yd. for a cost of $4, the present development price of Type C material. If ½ mil thick film is used, the cost of the film would be from 1 to 1½¢ a sq. ft. in contrast to the ¾¢ a sq. ft. for the ¼ mil thick film.

When Mylar is laminated to steel, the metal can be drawn into many shapes without damaging the film. In this process, the film eliminates the need for lacquering or tin plating and may serve as a drum liner.

In die forming operations, Mylar also prevents scratching in the mold and can be stripped off or left on the metal as desired.

Yarns—A most promising new use is as metallic yarn. In this case, a wide web of ½ mil thick Mylar is laminated to aluminum foil. If a yellow orange is added to the adhesive, a brilliant gold effect is created. The laminate is then slit into strips from an 80th to a 64th of an inch thick. These strips are then woven into cloth for dresses, tapestry, upholstery, drapes, and other fabric applications.

The film may also be vacuum coated with aluminum and then slit for this type of use.

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is unaffected by common solvents. Ironing does not discolor it or cause delamination of the yarn. Such fabrics have a brilliant luster and bright metallic sparkle that should be superior to other metallic yarns since the Mylar requires no supporting opaque textile fibers as are customarily used.

Packaging applications are not in the foreseeable future, since many important problems remain to be solved. There is no easy method of heat sealing Mylar as yet and price will probably be high for some time to come. Eventually, these problems will be solved just as adhesive and printing difficulties were recently overcome, but nobody knows when.

Properties—Some of Mylar polyester film properties are: Sp.G., 1.38 to 1.39; tensile strength, 17,000 to 25,000 p.s.i. (compared to 9000 for cellulose acetate and 2400 for polyethylene); tear strength is lower than polyethylene but greater than cellophane or acetate film; impact strength is three or four times that of any other known film; shrinkage at elevated temperature (150° C.) is less than 5%, but it all takes place in 10 min., and once so shrunken, it retains that level of dimensional stability; moisture absorption is less than 0.3% (low in comparison to acetate film and somewhat higher than polyethylene); it has a high degree of impermeability to water vapor but not quite as good as moistureproof cellophane or polyethylene; it has a marked resistance to passage of odors; is highly resistant to oils, greases, solvents, lard, motor oil, and vegetable oils.

Mylar polyester film is available in rolls from ½ to 40 in. in width at prices from $3 to $4 a lb., depending upon thickness. Yield varies from 61.73 sq. yd. per lb. of 25 gage and 30.86 sq. yd. of 50 gage per lb. down to 2.04 sq. yd. of 750 gage. Inquiries should be directed to the Film Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.

Plastisol Coating

NEW automatic equipment for high-speed coating with plastisols has been installed at the Smethport, Pa., plant of Houghton Laboratories, Inc., Olean, N. Y. The expanded facilities now enable Houghton to manufacture its Hysol plastisol for any specific purpose.

The new coating equipment can be adapted to a wide range of articles, some of which include dish racks, wire baskets, egg trays, glass tube carriers, electrical components, and all industrial coated items. In addition, Houghton offers the services of experienced technical personnel to recommend the exact Hysol coating for specified requirements.

High-Impact Alloy

PRODUCTION and sale of a polystyrene-rubber alloy, called Ampalloy, has been announced by American Molding Powder and Chemical Corp., 703 Bedford Ave., Brooklyn 6, N. Y. The product is a high-impact polystyrene concentrate which, when compounded in certain percentages with general-purpose polystyrene, will produce impact-resistant polystyrene molding compound.

Ampalloy is natural in color and is offered by the manufacturer to molders and compounders who color their own polystyrene by extrusion or milling. This impact concentrate is not recommended for dry coloring.

Samples and full information as to specifications and application may be obtained from the company.

Printing on Polyethylene

AVAILABILITY of licenses to use the Kreidl process for treatment of polyethylene surfaces to make them receptive to printing inks and adhesives has been announced by The Kreidl Chemico-Physical Co., 57 W. 58th St., New York 19, N. Y.

Because of his belief that bonding problems prevented development of a method for printing on polyethylene, Dr. Werner H. Kreidl tried a different approach. He devised a special kind of heat treatment which produces a surface on the polyethylene to which conventional types of ink can adhere. Neither the chemical properties nor the strength of the polyethylene is changed when the Kreidl process is used. The article may be printed either immediately after the treatment or at any time later. The printing is bonded so firmly that it will not be removed by the Scotch Tape test.

The operating costs of the process are reported to be almost negligible and royalty rates are claimed to be low. The treatment can be effected in a comparatively short time or at slow speeds if the treatment is to be done right at the extruder. The cost of the treating equipment, exclusive of winding or conveying, is about $1000 for film or tubing and a few hundred dollars for bottles.

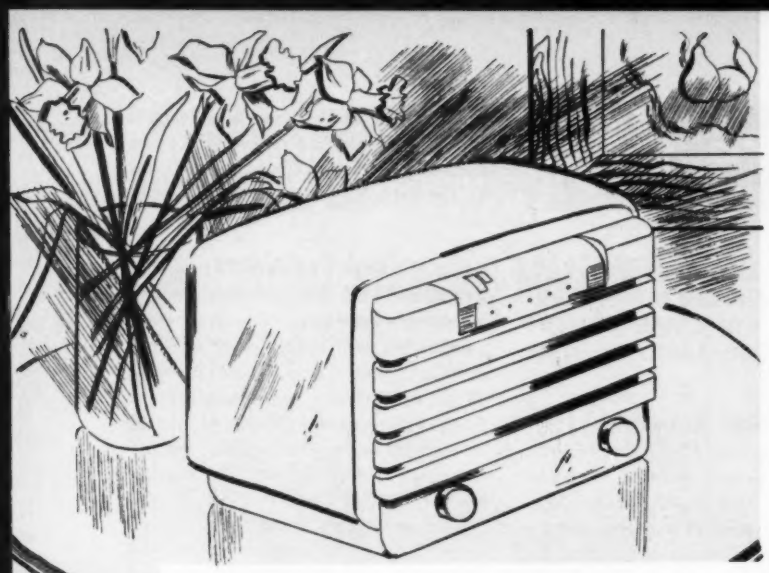
The process is now being used for the printing of polyethylene film and bottles and other containers. Preparations are reported for the industrial use of the process for printing and marking polyethylene coated paper and board, extruded shapes, and polyethylene coated wire and cable.

Ethyl Cellulose

PHONOGRAPH records have been a center of interest for their continually increasing use of plastics ever since World War II. But most of the talk has been about vinyl chloride and the tremendous growth of polystyrene; it often seems to be forgotten that ethyl cellulose flake entered this field almost immediately following the war and has been an important factor ever since. One of the largest of all record producers is claimed to have doubled his use of ethyl cellulose in 1953 as compared to 1952.

Ethyl cellulose is never used alone in records—it would probably be too high in cost. However, it is frequently used in combination with Vinsol or a bagasse resin, although the latter use has diminished in recent years. Most ethyl cellulose records are of the breakable type while rigid vinyl is of course supreme in the high-fidelity and non-breakable field. Polystyrene has moved into the break-resistant field at an estimated 8 or 10 million lb. volume last year and shellac is still around in some quantity and used at times when its price permits low-cost operation.

Growing Market—The large use of ethyl cellulose in records is partly due to its acceptability for the job and partly to a growing market for records. Industry men say that over $225 million worth of records were sold in 1953, 12% up from 1952 and a record high. They think sales may go to $300 million in five years. Num-



STEARATES *Aluminum, Sodium, Calcium, Magnesium, Lithium*—for "plastigels"... *Zinc, Calcium, Aluminum*—for internal lubrication, easier processing ... *Lead*—for heat stabilization, lubrication ... *Cadmium*—heat and light stabilizer for transparent formulations ... *Barium*—high temperature stabilizer ... *Calcium*—stabilizer for nontoxic formulations.

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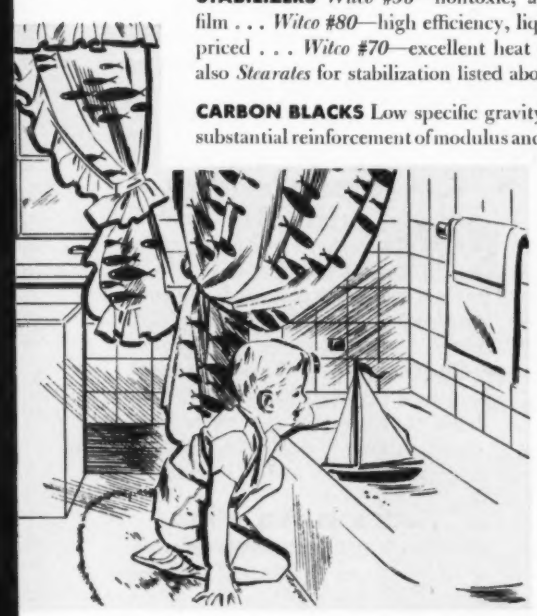

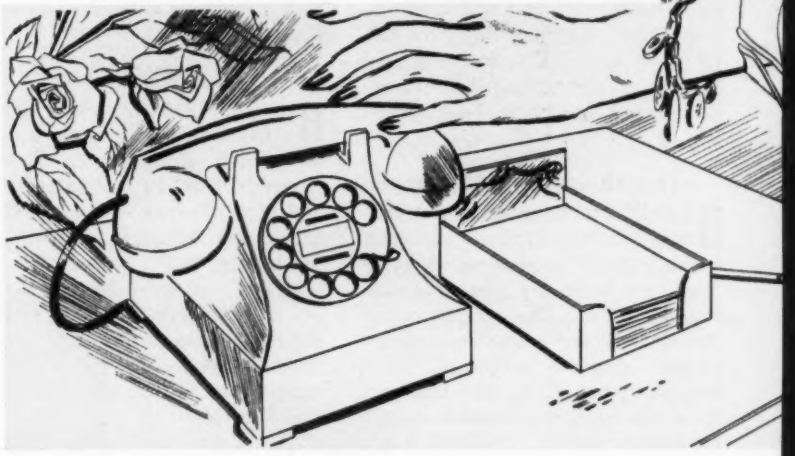

5 Witco Chemicals to aid plastics manufacturers

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ber of disks sold is thought to be 10 to 15% over 1952. The industry doesn't say how many, but the highest volume year is thought to have been between 300 and 350 million disks in the late Forties. In 1941, the figure was 100 million. A one-billion record year is expected by 1960. The amount of plastics involved is tremendous and apparently several different types are profiting from the population's yen for recorded music.

Shotgun Shells—Another interesting and possibly increasing use for ethyl cellulose in the near future is the often-mentioned shotgun shell. There is considerable enthusiasm for this product, but much more development work must be done before it is perfected. The ethyl cellulose shells were first molded in Denmark and a few odd lots have been sold in the United States. Ethyl cellulose seems particularly applicable because of its low-temperature resistance, water resistance, and sales appeal. It is also possible that ethyl cellulose shotgun shells may eventually become as low-cost as the conventional paper and brass shells now in use.

Varnish for Polyethylene

DESIGNED to protect inked surfaces, a polyethylene overprint varnish has been developed by American Resinous Chemicals Corp., Peabody, Mass. The coating, called Arcco C 602, is reported to have excellent abrasion resistance, good flexibility, and to be non-blocking. It may be applied by regular coating equipment and is presently being used in commercial quantities by a number of converters.

Samples of Arcco C 602 and technical information may be obtained from American Resinous.

Plastic-Glass Screens

PLASTIC-COATED fibrous glass insect screens may be found to have large potential use in military construction if they withstand exhaustive natural weather tests being conducted under rigorous climatic conditions by the Engineer Research & Development Laboratories, Fort Belvoir, Va. According to James M. Osborn, project engineer of the Laboratories' Materials Branch, long-range tests of the screens are under way at five different sites around the world.

Market Research

THE Chemical Market Research Association will meet at the Statler Hotel in New York City on May 20, 1954. The subject will be a check-up on chemical business volume for the first four months of 1954, compared to how the prognosticators predicted it would turn out when they made their estimates in 1953. Rubber, petrochemicals, synthetic fibers, and plastics will be thus compared. Speakers will be F. J. Emmerich, president, Allied Chemical & Dye Corp.; Dr. R. E. Hulse, vice president, National Distillers Products Corp.; R. P. Dinsmore, vice president, The Goodyear Tire & Rubber Co., Inc.; and J. D. Fennebresque, vice President, Celanese Corp. of America.

Atlas Rigid Sheet

HEAT-WELDABLE, non-plasticized polyvinyl chloride sheets in 9- by 4-ft. sizes and in thickness from 0.0001 to 2 in., known as Type I and Type III, are now available from The Atlas Mineral Products Co., Mertztown, Pa.

Type I, optimum chemical resistant sheet, is supplied in black under the trade name Ampcoflex. Type III, optimum impact sheet, is supplied in gray under the registered name of Pee Vee Cee.

More Micarta from Hampton

APPROXIMATELY one-half of the production facilities at the plant of Westinghouse Electric Corp.'s Micarta Div., Trafford, Pa., will be gradually moved to the division's plant at Hampton, S. C., over a period of two years.

George H. McBride, manager of Micarta Div., states: "This re-arrangement of facilities will enable us to more thoroughly utilize the manufacturing facilities at both Hampton and Trafford. The Hampton plant is closer to many of our sources of raw material and many of the markets for Micarta products are now located in that part of the country. At the same time, the Trafford floor space is needed for other types of production."

Food Containers

SIXTY-FIVE new polyethylene and styrene containers are in or near production at the main plant of Plastic Container Corp., West Warren, Mass., according to an announcement from the company. Eight of the 65 containers are now available; the remaining 57 will be on the market soon.

The new containers are offered with firm name imprinted on the polyethylene lids. Re-use design and attractive colors add to their value as consumer premiums. Other features of the products are locktight lids and protection against chipping.

Vinyltoluene Prices

ANNOUNCEMENT of a price reduction on vinyltoluene has been made by The Dow Chemical Co., Midland, Mich. The new tank-car price of the monomer will be 19¢ per lb., F.O.B. Midland, Mich., a price drop of almost 2¢ per pound.

Dow reports that the price cut results from current volume production of vinyltoluene which has heretofore been available in developmental quantities only, and also from the lower raw material cost of toluene.

The new plant for vinyltoluene, which is proving of interest in the fields of paints, polyester resins, synthetic rubber, and rubber reinforcing resins, is now in full production.

Plastics in Puerto Rico

PUERTO RICO'S plastics industry will receive additional impetus next year when the Commonwealth's first oil refinery will be able to bring petroleum derivatives right to the doorsteps of the 17 plastics plants currently operating on the island.

The refinery was started last winter and is expected to be completed in the spring of 1955. Already the establishment of four new plastics firms is under consideration in Puerto Rico, and officials point out that on the mainland most of the large plastics and chemical plants dependent upon crude petroleum derivatives have been established around refineries.

The first plastics plant in Puerto

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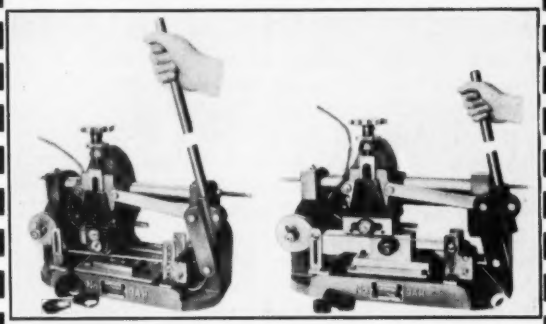
No. 9AH HOT STAMPING MACHINES



These machines use a roll die to mark flat parts and flat dies to mark tubes and round parts. The motor driven models are the last word in high production plastic parts marking.

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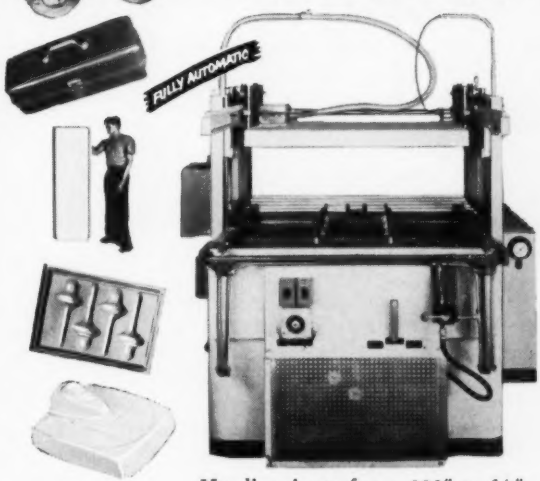

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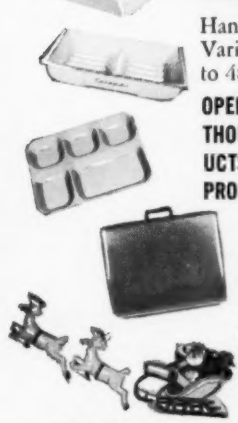

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Rico was established in 1946. Now its 17 plants employ nearly 1300 production workers who receive total salaries in excess of $1,450,000. Seven plants were organized in the period 1946 to 1951, seven more in 1952 alone, and three in 1953. A barometer of growth in the industry is contained in the value of shipments of manufactured plastics items from Puerto Rico, which increased from $1,580,000 in 1951-52 to $4,327,000 in 1952-53.

Knitkote Vinyl Backing

COTTON knit fabrics have been added to the line of backing materials for vinyl coating produced by Wellington Sears Co., 65 Worth St., New York 13, N. Y. Virtually every type and weight of cottons and synthetics—woven, non-woven, and knit—required in the coated fabric field are now available from the company.

The material, called Knitkote, is a circular knit cotton jersey backing which gives elasticity and stretch, plus shape retention, to coated fabrics. It is claimed that tests have demonstrated that finished materials with the new backing stretch up to 50% in width and more than 10% in length.

Knitkote is available in two styles: One is made from combed cotton yarn, 59 to 60 in., that weighs about 1 lb. per 2 yd.; the other is made of carded cotton yarn, 59 to 60 in., weighing 1 lb. for 1½ yards. Both materials come scoured, undyed, or dyed.

Estoglas Laminate

INTRODUCTION of a new laminate of copper-to-polyester-glass-mat sheet has been announced by Plastilight, Inc., 481 Canal St., Stamford, Conn. The company claims that the new material, Estoglas, offers physical and electrical properties superior to the paper-base phenolics, yet at a price materially lower than the epoxy resins. The low power factor of Estoglas makes it especially valuable as a base for etched circuits in radio, television, and radar applications.

The material consists of electrical-grade polyester resin and a filler of random-mat glass fibers, giving it uniform strength in all directions. The tensile and flexural strengths are in the neighborhood of 24,000 p.s.i. The standard sheet size is 24 by 36 in., in various thicknesses from 0.044 in. upwards, clad on one or both sides with 1-oz., 2-oz., or 3-oz. copper.

Epoxy Resin License

AN AGREEMENT for licensing Bakelite Co. to operate under the epoxy resin patents held or controlled by Devoe & Raynolds Co., Inc. has been completed by George C. Miller, president of Bakelite, and W. C. Dabney, president of Devoe & Raynolds. Increased production facilities now under construction by Bakelite will soon permit production of epoxies in much greater quantity.

Magic-Vulc Coatings

SEVERAL types of polyvinyl chloride coatings are now being marketed by Magic Chemical Co., 121 Crescent St., Brockton 2, Mass. Two types of coatings are available—a vinyl resin-pigment-solvent system and a plastisol system.

The solvent system is used primarily for coating by brush, spray gun, or dipping to protect tanks, racks, trucks, and other industrial equipment. The plastisol coatings, which require heat to harden, are also used as anti-corrosion coatings for many applications. In addition, they are provided in formulations that can be used for molding and casting.

Strain-Resistant Castings

PROTECTIVE windows on furnace charging dollies in the steel industry are being made of a copolymer of CR-39 and triallylcyanurate developed by Cast Optics Corp., Riverside, Conn. The copolymer, called HT-CR-39, is also used in tough applications such as observation windows and electrosonic degreasing equipment made by Detrex Corp. It is claimed to possess excellent heat-strength properties, as well as rigidity and clarity.

The company also reports that its CO-3, a thermosetting acrylic which is allyl based, is being widely used in applications where resistance to crazing and strain is important.

Short Run Molds

ONE of the perplexing problems in the plastics molding industry has always been that molds are generally too costly for short runs. In addition, there is frequently a long time lag between ordering and receiving a finished mold—from 12 to 17 weeks is not unusual.

A belief that these disadvantages can be overcome has been advanced by Philip A. Derham & Associates, Inc., Rosemont, Pa., where a method has been developed for making molds that are good for from 50 to 500 pieces and can be delivered in six weeks or less—sometimes three weeks.

Mold materials may be steel, beryllium, lead, Kirksite, or brass. They may be cast or machined. Molds have been made and 100 pieces turned out for as low as 150 dollars. There is no average—price depends upon the type of job desired.

Several molders have taken advantage of the opportunity to use these temporary molds while a permanent mold is being made.

Brooklyn Polytech Expansion

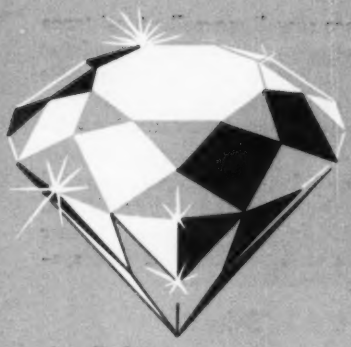
A CENTENNIAL expansion program is being planned by Polytechnic Institute of Brooklyn, 85 Livingston St., Brooklyn, N. Y., which will be spearheaded by Carl Whitmore, former president of New York Telephone Co., and Gen. William H. Harrison, president of International Telegraph & Telephone Co. Polytechnic is well known for its pioneering in the newer fields such as electronics, polymer chemistry and aeronautics.

The new program will be geared to overtaking, in terms of plant facilities, the tremendous academic growth which Polytechnic has experienced in its first 100 years.

Hooker's New Polyester

LIGHT stability, combined with exceptional fire resistance, is claimed for a tough, corrosion-resistant polyester resin produced by Hooker Electrochemical Co., Niagara Falls, N. Y. The company states that this is the first time these two properties have been combined in a polyester resin.

Hetron is the name of this series



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of polyesters. Fire-resistant Hetron has been available for approximately a year, but Hooker has now succeeded in making it light-stable as well, which greatly extends its outdoor uses. It shows no visible yellowing or change of surface gloss after more than 500 hr. in a weatherometer, which is equivalent to over one year's exposure in bright Florida sunlight.

Columbia in Plastics

ESTABLISHMENT of a new division for the manufacture of custom molded plastics products has been announced by Columbia Records, Inc., 799 Seventh Ave., New York 19, N. Y. The division will be called Cryton Precision Products and will operate at Columbia's factories in Bridgeport, Conn., Terre Haute, Ind., Los Angeles, Calif., as well as in its foreign factories in South America.

Long noted for its plastics developments in the manufacture of phonograph records, Columbia has recently completed a million dollar plant expansion program which involves extensive equipment.

James Hunter will be vice president and general manager of the new division.

Midwest S.P.E. Officers

OFFICERS of the Upper Midwest Section of The Society of Plastics Engineers have been recently elected as follows:

National director, Jerome L. (Jerry) Formo, Minneapolis-Honeywell; president, C. R. (Doc) Arnold, Doughboy Industries, Inc.; vice president, R. Kenneth (Ken) Erickson, Kenson, Inc.; and secretary-treasurer, C. L. (Cy) Barker, Acme Plastics of Minneapolis.

Decyl Plasticizers

COMMERCIAL production of a new phthalate and a new adipate —Cabflex O.D.P. (iso-octyl decyl phthalate) and Cabflex O.D.A. (iso-octyl decyl adipate)—has been announced by the Plastics Chemicals Div. of Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. Newest in the Cabflex line of plasticizers, Cabflex O.D.P. and Cabflex O.D.A. are priced no higher than the octyl esters, yet are lower in volatility and therefore offer improved flexibility permanence in vinyl compounds. They are manufactured from raw materials synthetically produced specifically for making esters.

The addition of these new plasticizers increases the Cabflex range of plasticizers for vinyl compounds to 10, including four phthalates, four adipates, one azelate, and one hydrocarbon oil plasticizer.

More Members for A.C.S.

AN EXTENSIVE drive to increase its membership is being made by the Div. of Paint, Plastics, and Printing Ink Chemistry of the American Chemical Society. One of the advantages of membership is that members will receive a preprint booklet giving the complete papers to be presented at each A.C.S. meeting long before final publication.

This particular division of the society has been growing at a considerable pace over the past few years, and is being used by chemical technicians in the plastics industry as a means for helping them keep in touch with various new developments that are still in the test tube or pilot plant stage in the plastics industry.

Anyone who wishes to join may send a check for $3, payable to the Div. of Paint, Plastics, and Printing Ink Chemistry, to Dr. A. C. Alexander, Code 3220-Naval Research Laboratory, Washington 25, D. C.

Teflon for Vinyl Pipe

TWENTY-EIGHT field installations of threaded, rigid polyvinyl chloride pipe and fittings, in which pipe dope based on Teflon was used, are reported as giving satisfactory results by Industrial Plastic Fabricators, Inc., Norwood, Mass.

The test installations were pipe and fitting lines in such chemical operations as electroplating, pulp and paper, photographic, pickling, and so on. All in existence for several months, the installations initially demonstrated ease of assembly; they have now shown freedom from maintenance as well as excellent resistance to corrosion. Particularly satisfying were the results obtained on a sizable nitric acid installation where the pipe compound proved its value immediately.

The Teflon-based pipe compound is reported to work equally well with special formula steels and other metals used for chemical pipe systems.

Solvent

NOW available from Baird Chemical Corp., 254 W. 31st St., New York 1, N. Y., is methyl cyclohexanone, a solvent particularly recommended for vinyl resins, nitrocellulose, natural and synthetic resins, as well as for the manufacture of lacquers, printing inks, and inks for printing on vinyls. In most cases, methyl cyclohexanone can be used to replace cyclohexanone, where a slower evaporation rate is required.

Samples, technical information, and prices may be obtained from D. W. Kallman, technical director of the company.

Dry Blending Service

CUSTOM compounding of dry blend elastomeric vinyl is a service offered to the trade by Lawrence Process Co., Inc., 360 Merrimack St., Lawrence, Mass. The company will dry blend to any customer's recipe, using any kind of material, at a nominal charge per pound over the base ingredient cost.

Several companies are using the Lawrence installation as a "proving ground" for new resins. The company carries a good stock of various vinyl resins, plasticizers, stabilizers, lubricants, and fillers for processing to the purchaser's specifications. The charges are about 4¾¢ a lb. over basic ingredient costs for the compounding, plus packing drum costs. The customer may, of course, supply special ingredients if desired. No pigments are used, but the company will help solve coloring problems if necessary.

Delivery may be obtained in three to five days when "stock" ingredients are used.

Destaticizers

ANOTHER new series of destaticizers for plastics, called Electrosols, has been announced by Alframine Corp., 4731 E. 52nd Dr., Los Angeles 22, Calif. They are liquids and solids

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E-S possesses desirable properties of both the more familiar monomeric esters and the true polymeric types. Epoxy-oxygen content adds stabilizing action when used with vinyl resins. A low order of unsaturation assures compatibility while a low viscosity allows for easy handling. High molecular weight reduces migration.

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Film and Sheeting	Fabric Coatings
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Extrusions	Moulded Articles

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DOP (Di-2 Ethylhexyl Phthalate)
DOA (Di-2 Ethylhexyl Adipate)
DOS (Di-2 Ethylhexyl Sebacate)
ODP (Iso-Octyl Iso-Decyl Phthalate)
TG-9 (Triethylene Glycol Dipelargonate)
O-16 (Iso-Octyl Palmitate)
DIOA (Di-Iso-Octyl Adipate)
DIOS (Di-Iso-Octyl Sebacate)
DBP (Dibutyl Phthalate)

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which are easily incorporated into all types of plastics materials, either in their monomeric form or in the milling process of the powdered plastics.

The amount required varies from 2% by weight for polyesters to 5% for polystyrene, or 6% for vinyl chlorides. The Electrosols are claimed to be particularly satisfactory when used in vinyl for phonograph records.

Fibrous Glass Rods

PHENOLIC fibrous glass tubular rods, offering the strength of steel yet highly elastic and extremely tough, are available from Narmco Sporting Goods Co., 600 Victoria St., Costa Mesa, Calif. The material, called Conolon Live Fiber, was first used for fishing rods but is finding wide acceptance in commercial products requiring close tolerances and tubular construction.

Electrical tests of tubes with ⅛-in. wall thickness at one megacycle at 21° C., resulting in an average dielectric constant of 3.9 and an average dissipation factor of 0.014, show its excellent electrical properties.

The company is an associate of Narmco Mfg. Co., 930 Grape St., San Diego, Calif.

Tin Stabilizer

COMMERCIAL quantities of vinyl stabilizer D-22 (dibutyl tin dilaurate) are now available from Carbide and Carbon Chemicals Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. It is stated that D-22 is a good heat and light stabilizer for chlorine-containing vinyl resins and is particularly suitable for use in clear vinyl compounds.

Low-Cost Plasticizer

DEVELOPMENT of a new, low-cost, highly compatible phthalate plasticizer has been announced by Pittsburgh Coke & Chemical Co.'s Plasticizer Div., Pittsburgh 19, Pa. Designated as Pittsburgh PX-114 (decyl butyl phthalate), this material is reported to reduce vinyl formulating costs without affecting quality and performance characteristics.

Pittsburgh PX-114 is a primary plasticizer and is comparable to dioctyl phthalate in low-temperature flexibility and mechanical properties. Heat and light stability are good, as may be expected from a dialkyl phthalate, and no special stabilization problems are involved. It is somewhat more volatile than D.O.P.

The company suggests use of this plasticizer for the manufacture of such items as garden hose, welting, gasketing, clothes line, inflatable toys, and sheeting. Plastisols and organosols containing PX-114 may be used for the manufacture of all types of slush molded or dip molded items and for dispersion coating operations.

A company spokesman reports that basic supplies of raw material to produce the new plasticizer are virtually unlimited. The material is now in production and is available for immediate shipment from the company's facilities in Pittsburgh, Pa.; Boston, Mass.; and Lyndhurst, N. J.

Vinylcards, Inc. is New Firm

A NEW company, Vinylcards, Inc., has been formed to manufacture plastic rulers, calendars, cards, calculators, etc. from vinyl sheet.

Vinylcards has purchased Cruver Mfg. Co.'s Fabricating Div., Chicago, Ill., and has moved the production equipment to the Power Bldg., Cincinnati, Ohio.

Arnold A. Hackman is president of the new company.

Dry Color for Vinyl

VINYLIZED colors for extruders of flexible and rigid vinyl products are now available from Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y. By means of the company's new process, calibrated, flushed colors are prepared as dry, free-flowing, dustless powders. Claremont reports that these products combine the convenience of color chips with the proved superiority of flushed colors, and also offer other features which surpass either method of preparing colors for extrusion.

On continuous runs, it is claimed that the downtime required for periodic cleanout of charred compound can be reduced as much as 25 percent. Also, uniform and rapid dissemination of color throughout the compound is reported when these vinylized colors are used.

Speed in Tooling

ANNOUNCEMENT of a plastic metal that can be used for drill fixtures and jigs, forming and drawing dies, holding devices, and models has been made by Chemical Development Corp., Danvers, Mass. Designated as Devcon, the material is a combination of fine steel powder and an unnamed plastic. It is claimed to be as easy to handle as modeling clay but that, after 2 hr. of hardening time, it becomes strong, tough, and rigid. Devcon will neither shrink nor expand and can be formed to practically every shape and contour for holding a piece to be drilled, milled, planed, ground, or broached.

Construction of holding devices, jigs, forming devices, and the like can be completed in a few minutes with the new material as compared to many hours when they are built by normal machine shop procedure.

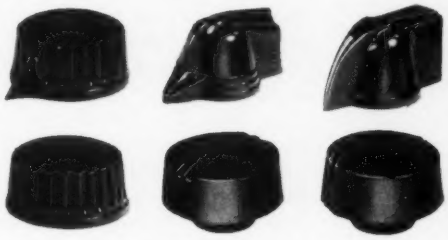
Built-In Plasticizer

VINYL chloride copolymers, in which one of the monomers involved—vinyl stearate—is obtained from inedible animal fats, have been developed bp the United States Department of Agriculture. The new copolymers may be either rigid or flexible, depending on the content of vinyl stearate. Copolymers with a high vinyl stearate content are similar to compositions of polyvinyl chloride and commercial plasticizers.

Dr. P. A. Wells, chief of the Agricultural Research Service's Eastern Utilization Research Branch, states: "The outstanding advantage of the new copolymers is the 'built-in' plasticizer. Because the vinyl stearate is chemically bound in the copolymers, this plasticizer cannot migrate or evaporate."

Copolymers with a low vinyl stearate content are essentially rigid. They have a lower milling temperature and a lower bulk viscosity temperature coefficient than commercial vinyl plastics now available.

Both the rigid and flexible types of the new copolymers may be cured with polyfunctional amines to infusible, insoluble resins. Because of their relatively low milling temperatures, they may be compounded



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and preformed at lower temperatures (about 200° F.) and then cured at higher temperatures (about 340° F.). The flexible type retains much of its flexibility after it is cured.

Detailed information on the preparation and properties of the new copolymers is available ir. a new USDA publication AIC-366, entitled "Vinyl Plastics Modified with Chemicals from Animal Fats: Copolymers of Vinyl Chloride and Vinyl Stearate." Copies of the publication may be obtained gratis from the Agricultural Research Service, Washington, D.C., or from the Eastern Utilization Research Branch, United States Dept. of Agriculture, Philadelphia 18, Pa. Samples are also available from the Eastern Branch.

Epoxidized Plasticizer

OF HIGHER than usual molecular weight for permanence, heat and light stability, and easy processing, a new epoxidized triester plasticizer has been developed by Rubber Corp. of America, 274 Ten Eyck St., Brooklyn 6, N. Y. The plasticizer, called RC Plasticizer ES, is claimed to possess desirable properties of both the more familiar monomeric esters and the true polymeric types.

Big Market?

A RECENT survey conducted by *American Motel* magazine suggests that a demand is developing for plastics cups in the motel industry. At present, only 5% of the cups used in motel bathrooms are made of plastics; 20% are paper. Today there are twice as many motels (50,576) as five years ago.

Medium High-Impact

CALLED Boltaron 7100, a new series of medium high-impact-sheet formulations has been made available by Bolta Products Sales, Inc., Lawrence, Mass. The new material is somewhat less costly than the older Boltaron 6100 series.

The price range for Boltaron 7100 is as follows: The 1/64-in. thickness sells for 12¢ per sq. ft. for 10,000 sq. ft. or more; 1/8-in. thickness, 71¢ per sq. ft.; and 3/8-in. thickness, $2.03 per sq. foot. Eleven different thicknesses are offered with prices in between those listed here.

The physical properties of the 7100 series are in some instances not as high as those of the standard 6100 series but are sufficiently satisfactory to open the door for many new jobs that were previously out of the question because of price. The new material is available in solid color only. The trim scrap is injection moldable.

The company is also offering a flame-resistant material which it claims has eliminated problems of brittleness and poor drawability. This material is designated as the 6700-A series.

Glass Mat Prices

ANNOUNCEMENT of a price cut on Uniformat products has been made by Ferro Corp.'s Fiber Glass Div., 200 Woodycrest Ave., Nashville, Tenn. The price reductions apply as follows: Quantities of 20,000 lb. or more have been reduced 5¢ a lb., making the new price 55¢ a lb.; in lesser quantities, prices remain the same; under 20,000 lb., 60¢ a lb.; and less than 2000 lb., 63¢ a pound.

Wide Vinyl Film

AVAILABILITY of Ultron vinyl film in 72-in. width has been announced by Monsanto Chemical Co.'s Plastics Div., Springfield, Mass. Formerly, the material could be purchased only in widths up to 54 inches.

The wider material is recommended especially for applications in which seams tend to mar the appearance of the product or increase fabrication costs. Fabrication costs are also reduced in the manufacture of agricultural and industrial covers used for the preservation of silage and for the protection of idle machinery against the elements.

Phenolic-Rubber Resin

KNOWN as 16840 black thermosetting material, an improved nitrile rubber-bearing phenolic molding compound of the general-purpose type, is available from Durez Plastics & Chemicals, Inc., North Tonawanda, N.Y. The modulus of elasticity of 16840 is lower in practical application than materials of similar type, and the impact strength is nearly 20% greater.

The company claims that the surface is good, with a higher gloss and less flow lines than existing materials of this type.

The low modulus of elasticity of the material allows it to be used in thin sections around inserts. It absorbs shock more readily than standard wood-flour- or flock-filled materials and may be quickly molded either by compression or the plunger method.

EXPANSION

The Visking Corp., Terre Haute, Ind., announces plans for the construction of a polyethylene film extrusion plant on a 20-acre site near Flemington, N. J. The new plant, which is expected to be in operation by August, represents an investment of approximately $1 million.

The company asserts that the demand for its Visqueen polyethylene film determined the need for expansion. The plant at Flemington will afford Visking three strategically located plastics plants in this country —the other two are in Terre Haute, Ind., and Centerville, Calif. **E. B. Cahn** will be general manager of all the plants, with headquarters in Terre Haute.

Detroit Stamping Co., 350 Midland Ave., Detroit 3, Mich., has completed its latest plant expansion, nearly tripling their original facilities. Some 11,000 sq. ft. of space has been added and the general offices have been enlarged and completely modernized.

The increased facilities at the main Detroit plant are in addition to the establishment in 1951-53 of two separate manufacturing units in Birmingham, Mich., for finished product assembly and tools and dies for customers' parts. The company claims that since 1951 the original area of these two plants has also been increased by 89 percent.

Textileather Corp. announces that a construction project costing more than $200,000 is underway at its plant in Toledo, Ohio. Included in the project are two warehouses—the larger warehouse will occupy 32,000

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sq. ft. of space, the other approximately 15,000 sq. feet. The larger unit will be used for storage of plastic-coated fabrics which are stock items and for warehousing of customer stocks; the smaller warehouse will be used exclusively for storage of finished corduroy.

Lapcor Plastics, Inc., 2214 Franklin St., Manitowoc, Wis., has acquired the Meladur line of Melmac dinnerware from General American Transportation Co., Chicago, Ill. Included in the sale are all equipment, tools, and good will connected with General American's Meladur operations. Lapcor will erect a new plant in Manitowoc to produce the dinnerware, which is expected to be completed by mid-summer.

General American has agreed to continue production of the line under Lapcor direction until its new facilities are ready.

Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, N. Y., will build a new phthalic anhydride plant adjacent to its present facilities in Elizabeth, N. J. At the same time, the maleic anhydride plant now in operation at that point will be greatly expanded. Construction of these additional facilities will boost Reichhold's total annual production of phthalic anhydride to 80 million lb.; of maleic anhydride to 10 million.

Fred P. Walden is product engineer of the new building program. **William O. Blesse** has been named plant manager in charge of operations of both units.

COMPANY NOTES

Deerfield Plastics Co., Inc., 271 Main St., South Deerfield, Mass., has been formed for the purpose of extruding thermoplastics. The firm has purchased the plant formerly owned by Arms Mfg. Co., manufacturer of fine leather goods. Deerfield wili extrude and fabricate any thermoplastic but are specialists in the production of acetate and butyrate tubing for packaging purposes.

Officers of the company are: **Elliott R. Barker,** president; **Kenneth T. Barker,** general manager and treasurer; and **Elliott R. Barker, Jr.,** production manager.

Conco Products, 578 Summit Ave., Jersey City 6, N. J., has acquired the plant and all manufacturing facilities of Permanent Label Corp. in Bloomfield, N. J. The company is equipped to silk screen, hot-stamp, and offset-print plastics, metal, wood, rubber, and cloth.

Plastic Pipe and Tube Corp., 224 S. Milpas St., Santa Barbara, Calif., has been organized to manufacture plastics pipe. The company has an initial capitalization of $100,000. One-third interest each in the new firm are held by Resin Industries, Santa Barbara; Anesite Co., Chicago, Ill.; and a group headed by Gen. Pierpont Morgan Hamilton, USAFR, Santa Barbara.

Anesite produces plastics pipe and Resin Industries has long been a producer of plastics tubing and sleeving.

The Rainville Co., 53 Hilton Ave., Garden City, N. Y., announces that **Thomas A. Ryan** will represent the company in the state of Connecticut and lower New York and **Nicholas Gerten, Jr.** in New Jersey, Philadelphia, and eastern Pennsylvania. Rainville has taken on representation for **Auto-Vac Co.,** Fairfield, Conn., to handle vacuum forming equipment in metropolitan New York and northern New Jersey. The company is also a distributor for Ingersoll-Rand compressors.

Ber-Design Associates, 402 S. 11th St., Newark 3, N. J., is the new name of the firm formerly known as Ber-Des Corp. The activities of Ber-Design have been expanded to include manufacture of pre-mold precision models, cast epoxy vacuum-forming molds, spray masks, zinc alloy castings for short run injection molding, cast resin jigs, and fixtures and forming dies.

Mirro-Products Co., High Point, N. C., has recently installed vacuum-forming equipment for production of three-dimensional displays in styrene, butyrate, vinyl, and similar materials. The equipment will also be made available for development of packaging components and package displays in cooperation with package designers, users, and manufacturers.

J. B. Henriques, Inc., 521 Fifth Ave., New York 17, N. Y., exclusive distributor of **I.C.I.** plastics, announces the apopintment of **Mark P. Malkovich** as salesman to cover the metropolitan area. Mr. Malkovich succeeds the late Bartholomew F. Sheehan, Jr.

Duraplastics, Inc., 20 East Ave., Bridgeport, Conn., has been formed to do contract custom molding. At present, the company has an 8-oz. Reed-Prentice machine in operation and can accept most injection molding jobs up to the limitation of its equipment.

The Richardson Co. has moved to new quarters located on Twenty-seventh Ave. & Lake St., Melrose Park, Ill. The change of address also includes the Lockland office of **The Richardson Co. of California.**

National Vulcanized Fibre Co., Wilmington, Del., has signed an agreement to acquire all outstanding stock of the **Marshall Bros.** paper mill at Yorklyn, Del. The acquisition will make Marshall Bros. a wholly-owned subsidiary of National. Actually, the development serves to cement a long-existing working relationship between the two companies. Since 1945, the entire paper output of Marshall Bros. has been utilized by National Vulcanized Fibre Co.

Corning Glass Works, 1949 Crystal St., Corning, N. Y., has named **Herbert Products, Inc.,** 74-32 Jamaica Ave., Woodhaven, N. Y., as its Eastern distributor of heating panels. Designed and constructed specifically for use as drying and heating units to meet graphic arts and industrial requirements, the Corning radiant panel is said to offer a new concept in infra-red heating that provides maximum absorption and temperature uniformity.

Complete information may be obtained from Herbert Products, Inc.

American Cyanamid Co. announces the following appointments in the Plastics and Resins Dept. of its Stamford Research Laboratories, Stamford, Conn.: **Dr. V. V. Lindgren** has been named manager; **R. Lindenfelser,** resin development group leader; **Dr. L. E. Cadwell,** surface coatings group leader; **H. M. Day,**

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reinforced plastics group leader; **J. A. Melchore,** thermoplastics group leader; and **Dr. J. K. Magrane,** molding and bonding group leader.

Lacquer & Chemical Corp., 214 Fortieth St., Brooklyn 32, N. Y., has formed the **Alaka Plastic Specialties Div.** for the manufacture and sale of plastisols, organosols, and latex compounds, as well as coatings for styrene, acetate, butyrate, vinyl, and acrylic, and for vacuum metalizing.

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., reports the appointment of the following product sales managers: **F. E. Woodill** (sheets and Vuepak), **M. G. Caine** (Opalon resins), **S. F. Sylvester** (textile resins), and **J. B. Clopton** (monomers). At the same time, the division appointed **J. D. Kirk** manager of sales training and **Robert F. Hill** assistant sales manager of Opalon resins and compounds.

Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., has appointed **Harry B. McClure** president of **Carbide and Carbon Chemicals Co.,** a division of Union Carbide. He succeeds **Dr. J. G. Davidson** who has been named chairman of Carbide and Carbon Chemicals and a member of the Appropriations Committee of Union Carbide. Dr. Davidson is also a vice president of Union Carbide.

Mr. McClure's first position with Union Carbide was as a research fellow on the Carbide and Chemicals Fellowship at the Mellon Institute of Industrial Research, Pittsburgh, Pa. In 1944, he became a vice president of Carbide and Carbon and in June 1953 was appointed executive vice president. In 1950, he received the first honor award of the Commercial Chemical Development Association for valuable service to the chemical industry.

General Electric Co., Pittsfield, Mass., announces that **George L. Hare** has been named application engineer of its Chemical Materials Dept. at Anaheim, Calif. He will supervise the conduct of the application engineering programs on polyesters and other resins for plastics.

John V. Schmitz has been transferred from the Research Laboratory in Schenectady, N. Y., to the Chemical Materials Dept. at Anaheim as product engineer.

Dr. Edward A. Kern has been appointed manager of engineering of the company's Silicone Products Dept. at Waterford, N. Y. Dr. Kern has been associated with laboratory research activities at G-E's Transformer Div. in Pittsfield since 1942.

Emery Industries, Inc., 4300 Carew Tower, Cincinnati 2, Ohio, has opened a direct sales office and warehouse in Cleveland, Ohio. Schibley & Ossmann, Inc. had formerly serviced Emery's accounts in northern Ohio. The new office will be responsible for the sale and service on all Emery products, including fatty acids and derivatives, plasticizers, textile oils, and emulsifiers.

Maple Leaf Plastics Ltd., 375 Danforth Rd., Toronto 13, Ont., announces that its Styleware and Ever-Maid dinnerware has won the 1954 Design Award of the National Industrial Design Committee for the second consecutive year. Separate awards were given to the company for its serving bowl and servicing platter.

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, announces the appointment of the following sales engineers: **Raymond L. Moreland** and **Harry R. Chase** have been named sales engineers of the Pittsburgh, Pa., sales office and **Bruce H. Lowe** and **Elton W. Turner** sales engineers at the Detroit, Mich., sales office.

M. Swift & Sons, Inc., 10 Love Lane, Hartford 1, Conn., manufacturers of gold leaf and hot die stamping products, has opened a branch office at 3204 W. Sixth St., Los Angeles, Calif. **George E. Connors** will be in charge of the new office.

Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y., announces that **William L. Milheim, William B. Sinclair, W. D. Matthews,** and **J. W. Morton,** all of whom have been connected with the sales department of Celanese's Chemical Div., have been promoted to district sales managers. Mr. Milheim is now in charge of the Southeastern district with offices in Charlotte, N. C.; Mr. Sinclair will cover New England with offices in Boston, Mass.; and Mr. Morton and Mr. Matthews will handle the metropolitan and Middle-Atlantic territories, respectively, from the New York City office.

Linde Air Products Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., has named **The C. P. Hall Co.,** 5145 W. 67th St., Chicago 38, Ill., as distributor of Linde silicone emulsions and oils.

Elm City Rubber Co., 73 Wallace St., New Haven 8, Conn., has opened an office at 9 E. 40th St., New York 16, N. Y. **S. Picker** has been appointed sales manager of the new office and will be in charge of domestic and overseas sales.

Chicago Molded Products Corp.'s Campco Div., 1020 N. Kolmar Ave., Chicago 51, Ill., has named **Electrical Specialty Co.,** 316 Eleventh St., San Francisco, Calif., as its distributor of Campco rubber-styrene alloy sheet. Electrical Specialty Co., headed by **L. L. Gribble** and **W. J. Martin,** is a pioneer distributor of plastics, metal alloys, and electrical insulation and equipment. The company also has offices in Los Angeles, Calif.; Denver, Colo.; and Seattle, Wash.

Plastic Container Corp., West Warren, Mass., has appointed **Charles S. Conklin** as sales manager and **E. Don Pam** as New York district sales manager. Mr. Conklin joins Plastic Container after five years as Eastern sales manager of Harriet Hubbard Ayer, Inc., a Div. of Lever Bros. Mr. Pam comes to the company from Plax Corp., where he was New York district sales manager for three years.

Minneapolis-Honeywell Regulator Co., Wayne & Roberts Aves., Philadelphia 44, Pa. has named **C. L. Peterson** as divisional vice president of the **Brown Instruments Div.** and **O. B. Wilson** as general sales manager.

Loma Plastics, Inc., 3000 W. Pafford St., Fort Worth 11, Texas, has appointed four new representatives for Lomaware Housewares as follows: **W. J. Sheehan** will cover all of New York State, with the exception

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Flexibility in the design of the new I.C.I. Plastics Division Research Laboratories has been achieved by the functional use of plastics materials, themselves derived from polymers produced by Plastics Division.

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The service lines round the outside walls include drip waste pipes of 'Alkathene' brand polythene, while the unit flanged drainage pipes are of 'Darvic' rigid p.v.c. Flush-mounted diffusing covers on the lighting fittings are made from opal 'Perspex' acrylic sheet.

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of New York City; **Dennis E. Sullivan** will handle metropolitan New York; **Louis M. Harmelin** has been assigned the states of Pennsylvania, Maryland, Washington, D. C., and New Jersey; and **Phillip Johnson** will represent Lomaware in Colorado, Idaho, Nevada, Wyoming, Montana, and New Mexico.

B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio, announces that **P. J. Weaver** has been named manager of the sales development laboratories at Avon Lake, Ohio, and **W. E. Manring** technical service manager of the plastics materials department in Cleveland. Mr. Weaver joined The B. F. Goodrich Co., Akron, Ohio, in 1943. He came to BFG Chemical in 1944 as a chemical engineer. He became technical service manager in 1951, a position which he has held until now. Mr. Manring joined BFG Chemical in 1948 as a technical engineer at the Avon Lake sales development laboratories, after working for American Cyanamid Co. for 11 years in both technical and sales capacities. In 1951 he was made a development supervisor, and the following year moved to BFG Chemical Co's Cleveland headquarters as a product engineer, a job he held until his recent appointment.

PERSONAL

S. L. Brous, general manager of the Chemical Materials Dept. of **General Electric Co.**, has recently been appointed to serve on the Admissions Committee of the Commercial Chemical Development Association, the Plastics Committee of the Manufacturing Chemists Association, and the Plastics Advisory Committee of the **Lowell Technological Institute.** Mr. Brous is one of six industry representatives serving in an advisory capacity to assist in setting up a program leading to a B.S. in plastics engineering.

The four-year course, being planned at Lowell, will be aimed at giving the industry what it requires in a plastics engineer.

Christy H. Madsen has been named production manager of **Naugatuck Chemical Div., United States Rubber Co.**, Naugatuck, Conn. Mr. Madsen, formerly assistant production manager, replaces John C. H. Wendes, who has retired after 25 years with the company.

R. J. Southwell, general sales manager of **Canadian Resins and Chemicals Ltd.**, 600 Dorchester St. W., Montreal, Que., since 1948, has been appointed a vice president of the company. Mr. Southwell began his career with the plastics group of Union Carbide and Carbon Corp. in 1935; in 1939, he was appointed eastern technical representative of Bakelite Co., with headquarters successively in New York, Cleveland, and Detroit.

Thomas Dudley Cabot has been elected president of **Godfrey L. Cabot, Inc.**, 77 Franklin St., Boston, Mass. He has served as executive vice president for a number of years and succeeds Dr. Godfrey L. Cabot, founder and long-time president of the company. Dr. Cabot will remain chairman of the board.

Ralph H. Stalbaum has joined the sales staff of the New York district office of **F. J. Stokes Machine Co.**, 5500 Tabor Rd., Philadelphia 20, Pa.

Robert S. Ames, since 1951 manager of canopy and laminates operations of **Goodyear Aircraft Corp.**, Akron 16, Ohio, has been re-appointed to the Subcommittee on Aircraft Structural Materials organized by the National Advisory Committee for Aeronautics. Mr. Ames is presently on a one-year leave of absence to complete requirements of an A. P. Sloan Fellowship in the executive development program, School of Industrial Management, at the Massachusetts Institute of Technology.

Cyrus E. Silling, Jr., is now manager of **Witco Chemical Co.'s Plastics Chemicals Div.**, 260 Madison Ave., New York 16, N. Y. His former affiliations were with Apex Div. of Food Machinery & Chemical Corp. and Hercules Powder Co., Inc.

Horrall Harrington has been named Midwest district sales engineer of **Blaw-Knox Co.'s Chemical Plants Div.**, Farmers Bank Bldg., Pittsburgh, Pa.

Milton R. Radcliffe has been appointed project engineer of **Textileather Corp.**, Toledo 3, Ohio. Mr. Radcliffe recently joined the company after serving as plant manager of Charles S. Fields Co., Lodi, N. J. He has also been associated with the plastics divisions of Firestone Tire & Rubber Co. and O'Sullivan Rubber Co.

Ernest A. Felker, 2109 Tolosa, Dallas, Texas, has been named color sales and service engineer of **Ferro Corp.**, Nashville 20, Tenn., and will cover the Southern territory.

Leo Kagan has been elected vice president in charge of sales of **Elco Corp.**, Philadelphia, Pa., at a recent board of directors meeting. Mr. Kagan joined the company in 1952, where he has been prominent in the development of sales for electronic tube sockets, shields, and connectors.

A. T. Olsson has been appointed assistant to the sales manager of **Acheson Colloids Co.**, Port Huron, Mich. Mr. Olsson was formerly sales engineer for Acheson in Detroit, Mich.

MEETINGS

April 27—Association of Consulting Chemists and Chemical Engineers, Inc., Symposium and Banquet, Hotel Belmont Plaza, New York, N. Y.

May 16-19—American Institute of Chemical Engineers, Spring National Meeting, Kimball Hotel, Springfield, Mass.

May 16-19—Western Merchandise Exhibitors Assn., Fifth Annual Western Variety Store Merchandise Show, Scottish Rite Auditorium, San Francisco, Calif.

May 17-20—Second Basic Materials Exposition and Conference, International Amphitheatre, Chicago, Ill.

June 7-10—Society of the Plastics Industry, Sixth National Plastics Exposition, Public Auditorium, Cleveland, Ohio.

July 12-16—National Housewares Manufacturers Assn., Twenty-first National Housewares Exhibit, Auditorium, Atlantic City, N. J.

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WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

HYDRAULIC PRESSES: 1—Erie Belt Press, 4242 Tons, 2—8" openings, 18'—0"x52" Steel Steam Platens, 6 rams—30" dia. x 16" stroke. 1—Birdsboro, 2000 Tons, down-acting ram 34" dia. x 14" stroke, 48" DLO, 42"x42" bed area. 1—Clearing, 500/1500 Tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrel, 393 Tons, 48"x 48" steam platens, 2—15" openings, 4 rams 10" dia. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 Tons, down-acting ram 11½"x9½"x6" stroke, 22"x20" bed, 24" DLO, self-contained, 15 HP MD Vickers Pump. Unit PRACTICALLY NEW. 1—Watson-Stillman, 100 Tons, 11¾"x12" platens, 22½" DLO, ram—8" dia. x 15" stroke, complete with 3 HP MD Pump. 1—HPM, 100 Tons, 18"x18" platen area, ram—8" dia. x 18" stroke, 30" DLO, Steel Cylinder—4000 PSI. 2—Burroughs, 75 Tons, down-acting, 17½"x17" electric-heated platens, 13½" DLO, ram—8" dia. x 10" stroke, complete with 7½ HP MD Oilgear Pump. 1—HPM, 35 Tons, down-acting ram 6" dia. x 6" stroke, 15" DLO, 12"x6" bed area, self-contained. 1—Induscо Laboratory Press, 12 Tons, Hand Operated, 8"x8" electrically heated platens. NEW. — INJECTION MOLDING MACHINES: 1—Plasticor Vertical 2 oz., Electric Heated, Hand Operated. 1—HPM Horizontal Model 54, 2 oz., 22 Ton Clamp, 12 Ton Injection, Manual Control, Oil Heated. 2—HPM Model 200-H, 9 oz., 200 Ton Clamp, 31 Ton Injection, Electrically Heated, Full Controls, Excellent Condition, In operation. 2—Impco Model VF-822A, 22 oz., 350 Ton Clamp, 100 Ton Injection, Electrically Heated, Full Controls, Excellent Condition. In operation. Also: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683-P Frelinghuysen Avenue Newark 5, New Jersey. Tel.: Bigelow 8-2500. What have you for sale? What are you looking for?

2—LEOMINSTER 8 oz. Injection Molding Machines complete with Temperature & Electric Controls. Late Type. Reasonable. Excellent condition. Reply Box 1727, Modern Plastics.

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STOKES ROTARY PELLET PRESSES (3) 16-punch RD-3 and 15-punch RDS-3. (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #1½ stainless steel rotary cutter. Mikro Pulverizers #2-TH, #2-SI. Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila., 22, Pa.

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(*Continued on page 232*)

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(*Continued from page 230*)

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Scrap Polyethylene in any form.
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WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N.Y. Telephone: MAin 5-7450.

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Tumbler Mold for 8 ounce injection machine. Send particulars and samples to
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BRUSH MOLDS & BRUSH MACHINERY, injection molds for ladies, men's, military, nail, toothbrushes, etc. Send particulars & samples. Box 1000, REALSERVICE, 110 W. 34 St., NYC.

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FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 1702 Modern Plastics.

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VINYL CHEMICAL ENGINEER
OR CHEMIST
Experienced on heavy or light gauge calendering. Real opportunity with progressive company.
Reply Box 1726, Modern Plastics.

ASSISTANT SALES ADMINISTRATOR for New York City flexible bag and printing plant. Must know markets, have ability to write promotional material, guide field men, and understand the phases of flexographic printing. Write full details. Box 67, REALSERVICE, 110 West 34th St., N.Y.C.

EXPERIENCED MAN to take complete charge of color compounding and reprocessing plant. Unlimited possibilities for right party. Reply Box 1730, Modern Plastics.

PLASTICS MATERIALS SALESMAN—midwest area—Aggressive man interested in position with growing company—knowledge of molding and extrusion of plastics materials helpful but not essential—must have car and be able to travel. Write details—Reply Box 1721, Modern Plastics or phone Bi 8-0311 Chicago.

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AND RESINS
Aggressive medium size plastic producer in Midwest needs man with 3-10 years background in development and production of ureas. Position offers real opportunity in a new division and field of application with this company.
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WANTED—Young Chemist or Chemical Engineer with experience in reinforced fiber glass to join development group in plant of growing, established manufacturer. Send details of background, experience, salary, etc. to THE GENERAL TIRE & RUBBER CO., Marion, Indiana. Replies confidential.

LOS ANGELES PLANT NEEDS highly experienced man for complicated vacuum and deep draw operations, on plexiglass Royalite and Dow. Must be thoroughly experienced with all phases of tooling and able to do some tooling himself. Must have thorough mechanical background. Application will be treated very confidentially. Reply Box 1712, Modern Plastics.

PRODUCTION EXECUTIVE—PLASTICS. For small plastics manufacturing division of substantial company. Exceptional potential growth. Experience with injection and compression molding; manufacturing methods; tool and die design; and production planning. Location—Mid West. Submit personnel summary and salary desired in reply. Reply Box 1736, Modern Plastics.

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CHEMIST—Experienced in coatings for Research on lacquers, hot melts and waxes for Wisconsin Paper Manufacturer. Give training, experience, and salary expected in letter. Reply Box 1708, Modern Plastics.

(*Continued on page 234*)

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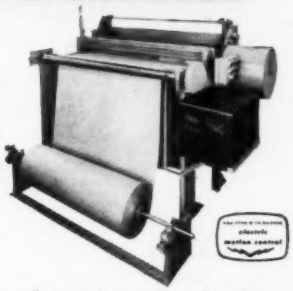

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Plastic Glass Corporation manufactures cast acrylic rods in all diameters up to 1" for regular applications; for special purposes which can use a sanded finish, we have diameters up to 2⅞".

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Permit rapid wet painting, one color after another. Clean, sharply defined letters and decorative effects obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas. No fogged edges. After-wiping or buffing-off of overspray unnecessary. The "loose" inside of letters and numerals, such as "0" and "6", is held in position by arched bridging to eliminate objectionable "ties". Plug-type masks [keep depressed areas clear, while spraying background]; lip-type masks [protect background while painting depressed areas]; and block-cutout, plane-surface type masks.

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CLASSIFIED ADVERTISING

(*Continued from page 232*)

INJECTION MOLDING FOREMAN and Two Assistant Shift Foremen wanted by rapidly expanding injection molder. Must be thoroughly experienced in setting up machine cycles and carrying out machine maintenance. Must have mechanical ability. Knowledge of finishing and painting operations helpful. Salary open. Excellent future for qualified person. Location, Virginia. Reply in confidence to President, Box 1713, Modern Plastics.

VINYL COLOR MATCHER
Require man experienced in color matching and production color control in vinyl film and sheeting operation.
Reply Box 1710, Modern Plastics.

FOREMAN OR ENGINEER EXPERIENCED Fiberglass moulding wanted for senior position in New Company located in Puerto Rico. This position offers advancement to executive management level promptly for a person interested. Actual experience in molding Fiberglass will be most essential. Attractive salary available. Puerto Rico is part of The United States and offers delightful living conditions. Reply Box 1734, Modern Plastics.

FOREMEN (4). Injection Molding. Top men only. Must be capable of full responsibility for production, quality, maintenance and personnel. Unusual opportunity to join a well integrated and growing, large Chicago molder. Replies also solicited from experienced set-up and maintenance men who know equipment and have supervisory capabilities. Reply in confidence to Company President. Salary open. Reply Box 1701, Modern Plastics.

WANTED—Plastics Extrusion Engineer—excellent opportunity and good starting salary, reply Box 1715, Modern Plastics.

MATERIAL AND PROCESS ENGINEER—PLASTICS:
M. E. or Chemical Engineering degree with a minimum of two years experience in one or more of the following: Metallic Sandwich (Stress Background); Glass and Optics (Design & Optical Test); Thermoplastics (Transparent Materials-Processing); Sealants (Fuel and Pressure Applications—Test and Development). Applicants should apply to Engineering Personnel Office, NORTH AMERICAN AVIATION, INC., Columbus 16, Ohio.

WANTED: 1. Production Supervisor, 2. Sales Engineer. Must be familiar with either production or application of fiber glass reinforced plastics. Newly established manufacturer in Ohio offers unusual opportunity to ambitious and able individual between ages of 28 and 40. References and resume of experience must accompany each reply, all of which will be treated confidentially. Reply Box 1718, Modern Plastics.

WANTED—SALESMAN with a Following. Experienced in Injection and Compression Molding. Tremendous opportunity for the right person. Remuneration open. STANLEY SAPERY COMPANY, 341 Madison Avenue, New York 17, N.Y.

SALES ENGINEERS to represent old-established injection molder. Press capacity 4 to 200 ounces. Tool room, painting, silk screening, hot stamping—all conveyorized. Straightline assembly. Automatic packaging equipment. Prefer experienced men and men with industrial contacts. Also men controlling one or more special deals. Large midwest plant. Give complete details. Personal interview to follow. Reply Box 1700, Modern Plastics.

POLYETHYLENE EXTRUDER FOREMAN
Eastern plant requires experienced extruder foreman with full knowledge of technical & mechanical "know how." Excellent salary & good future. Send full resume. Reply Box 1716, Modern Plastics.

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COATING, LAMINATING, EXTRUSION. Impregnation, Gravure Printing, Foil Rolling, Vacuum Metal Evaporation. Rubbers, plastics, thermosets and latex. Aluminum, papers, films and textiles. Defense and commercial. Extreme temperatures. At present chemical director AaA-1 multi-plant company which operates in all these fields. Wish to change; available for two days per week on permanent basis. Development, Production or Marketing. Individual problem, or general supervision or special conditions. Reply Box 1709, Modern Plastics.

GENERAL MANAGER, currently managing plastic pipe plant, with broad experience in molding, extrusion, and reinforced plastics seeks connection with more soundly financed company. Chemical engineer by training, well versed in development, engineering, and production of plastics since 1939. Prefer south or southwest location. Interested only in position of responsibility. Reply Box 1738, Modern Plastics.

PRODUCTION FOREMAN with seven years experience in all phases of Vinyl Plastic Calendering. Knowledge of "Z" and inverted "L" type Calenders producing light and heavy gauge film and sheeting. Have wide plant experience in productivity and efficiency. Interested any phase. Reply Box 1722, Modern Plastics.

SALES ENGINEER FOR EXTRUDED PIPE and Other Products. For the past five years have had vast experience handling technical sales, management, and merchandising of extruded pipe and molded fittings, along with custom work. Worked with polyethylene, butyrate, vinyl, acetate, styrene and other thermo plastics. Able to relocate very easily. Can furnish excellent references. Seeking position as general manager or director of sales. Reply Box 1732, Modern Plastics.

REINFORCED PLASTICS PRODUCTION ENGINEER—Eng. degree, aggressive, cost conscious. Solid development and production background in matched die, contact, vacuum and plug molding and corrugated and flat sheeting. Also know vinyl plastisols and vacuum forming of thermoplastics. Have managed small molding plant including sales, estimating, product design and mold and equipment design. Reply Box 1725, Modern Plastics.

SALES AGENTS WANTED

EXCLUSIVE TERRITORY—SALES REPRESENTATIVES. Well-established, aggressive company making beryllium copper pressure-cast mold components has several openings in fully protected territories for alert, experienced men to handle line. Prefer manufacturers' representatives now calling on plastic mold makers and injection molders doing own tooling. Our staff knows about this ad. Write in confidence—stating age, education, experience in detail. Reply Box 1711, Modern Plastics.

SALES REPRESENTATIVE (Distributor) Wanted: A successful manufacturer of plastic thermosetting items is desirous of entering the thermoplastic extrusion field. Would consider Sales Company for national distribution. This is an excellent opportunity to connect with an aggressive, young organization with a successful background of twenty-five years. Reply Box 1714, Modern Plastics.

EXPANDING, prominent manufacturer of Anti-Static Compounds and Non-Silicon Mold-Lubricant desires additional top-notch SALES REPRESENTATIVES throughout the U. S. & Canada. Every Plastic manufacturer or user, a sales potential. Excellent commissions, assigned territories & finest cooperation. Reply fully and in confidence to Sales Manager, MERIX CHEMICAL CO., 1021 E. 55th St., Chicago, 15, Ill.

MANUFACTURER'S REPRESENTATIVE. Old established New England custom molder of plastic products desires manufacturer's representative familiar with industry and industrial requirements for New York, New Jersey, Pennsylvania and Maryland area. Equipped to handle volume production in compression, transfer and injection molding. Commission basis. Please submit complete resume. Reply Box 1735, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Reply Box 1705, Modern Plastics.

SALES REPRESENTATIVES wanted by prominent established weaver of Fiberglass and other industrial fabrics for New England and midwest territories. Must have experience with industrial trades. Reply giving experience, present lines and territory wanted. All replies confidential. Reply Box 1737, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE for Chicago and Detroit areas—newly established custom molder of fiber glass reinforced plastics who is only interested in volume sales suitable to production by matched metal mold technique offers exclusive territory on commission basis. Reply: P.O. BOX 857, Cleveland 22, Ohio.

SALES REPRESENTATIVE WANTED: We are looking for an experienced manufacturer's representative to sell for us on a commission basis. Custom compression, plunger, transfer, and hand molded items are what we desire to quote on in volume. Reply Box 1723, Modern Plastics.

TEFLON—Established organizations of representatives wanted for a few of the major industrial areas to sell DuPont's Teflon and Dixon's Dulon fluorocarbon plastics. Exclusive territory selling for a DuPont selected and a growing Teflon processor. Write DIXON CORPORATION, Bristol, R. I.

MANUFACTURER'S REPRESENTATIVE wanted for plastic extrusion and plastic fabricating concern. Complete shop facilities. All territories open. CALCO MANUFACTURING CO., Oakland Ave. & Penn R.R., Washington, Penna.

MISCELLANEOUS

FOR SALE: PLASTICS HOME STUDY Course by West Coast University formerly offered under the name of Plastics Industries Technical Institute. Consists of 40 lessons. Those interested in the outright purchase of manuscript, offset plate negatives, and copyrights, please communicate with WEST COAST UNIVERSITY, Extension Division, 1601 S. Western Ave., Los Angeles 6, Calif. This course will be sold to the highest offer by May 31, 1954.

FOR SALE—McNeil Molding Machine—Model Ks-1—Manually operated injection plastic molder—2 oz. capacity. Priced very low. Also have for sale—Catalin sheets and rods in various sizes and colors. PARAMOUNT BUCKLE & BUTTON CO., 333 So. Market St., Chicago, Illinois.

WANTED TO REPRESENT—Custom Molder capable doing precision Nylon and other injection molding up to at least 60 ounce. Have considerable past experience. Good contacts both automotive and refrigeration industries. Reply Box 1707, Modern Plastics.

INDUSTRIAL BUILDINGS—Gastonia, N. C. 52,500 sq. ft. mill construction; 6,400 sq. ft. masonry—owner will add up to 20,000 sq. ft. Also, will develop 25,000 sq. ft. or more manufacturing space for lease. Write for free brochure, GAS. IND. DIVER. COMMISSION, Box 823, Gastonia, N. C.

ACETATE MOLDING POWDER—25¢ per pound F.O.B. New York. Opaque colors only—immediate shipments. Will purchase Impco Hydraulic Press—Dimethyl and Diethyl Phthalate. PEERLESS CHEMICAL CORP., 181 Greene Street, N. Y. C. 12.

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For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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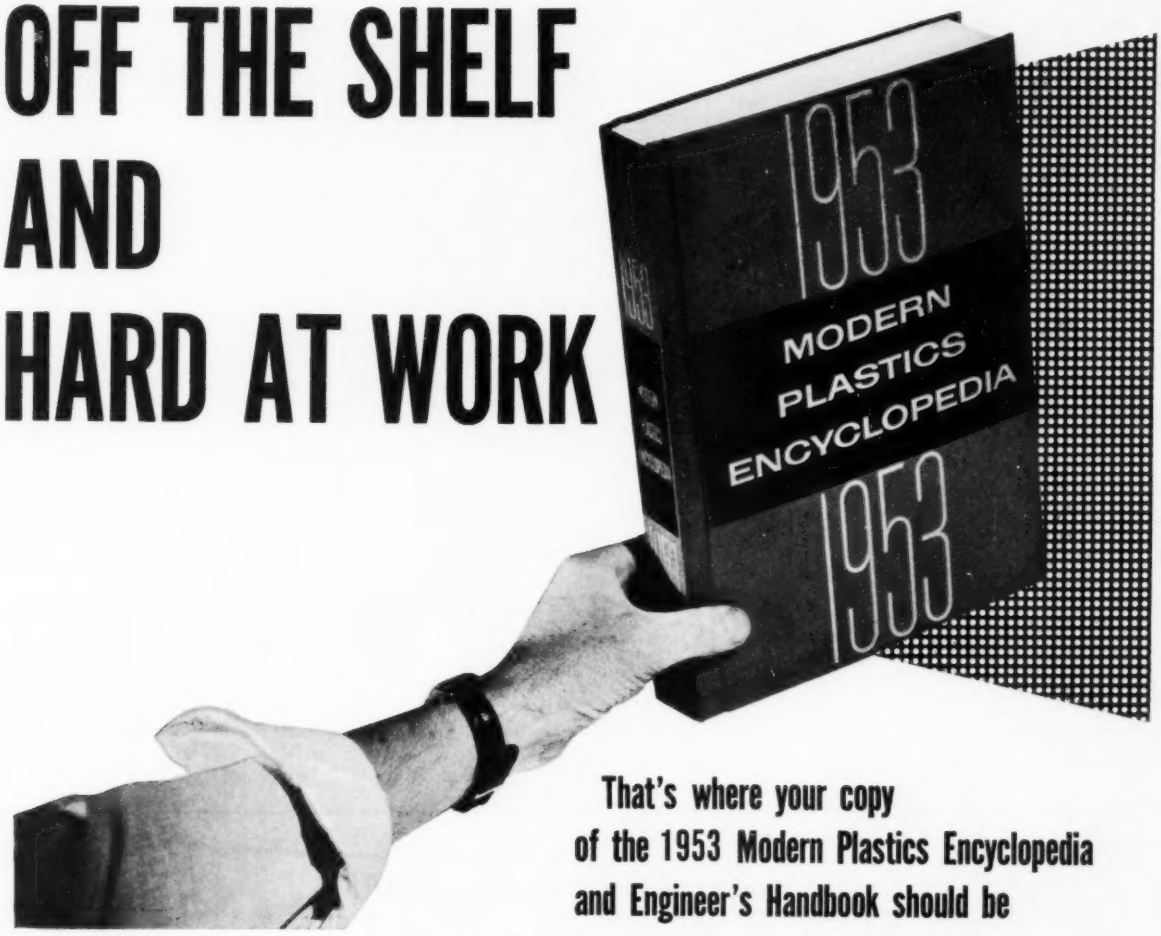

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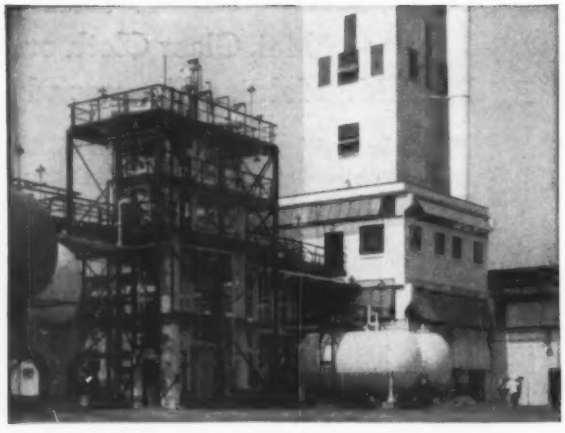
New, completely integrated plant produces Diamond PVC



From 500 feet down this plant draws cool, clear well water, pure enough to drink. But it's further purified, deionized and deaerated before it's used to process DIAMOND PVC. *One of the many safeguards to assure uniform high quality.*

Now America's plastics industry has a great new source of polyvinyl chloride. DIAMOND ALKALI's new, completely integrated plant, most advanced in the world, now is producing high-quality PVC.

Every production step, from raw materials to resin, is under the control of DIAMOND engineers and is located at one DIAMOND plant. This gives added assurance of uniform high quality and minimizes the possibility of production and transportation delays. DIAMOND customers will have the assurance of quality and prompt delivery always associated with DIAMOND products.

Complete research, testing and product development laboratories, manned by experienced DIAMOND engineers, are located at the Houston plant and the DIAMOND Technical Center at Painesville, Ohio. The assistance of the staff and the laboratory facilities are available to all DIAMOND customers.

For information on DIAMOND PVC and the cooperation of our technical staff, write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

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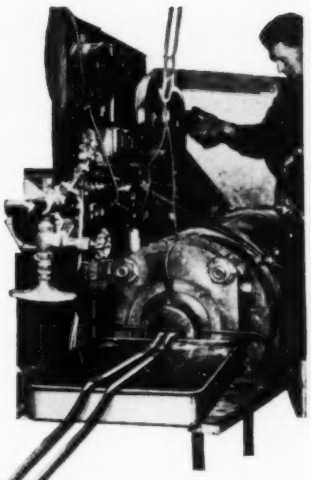
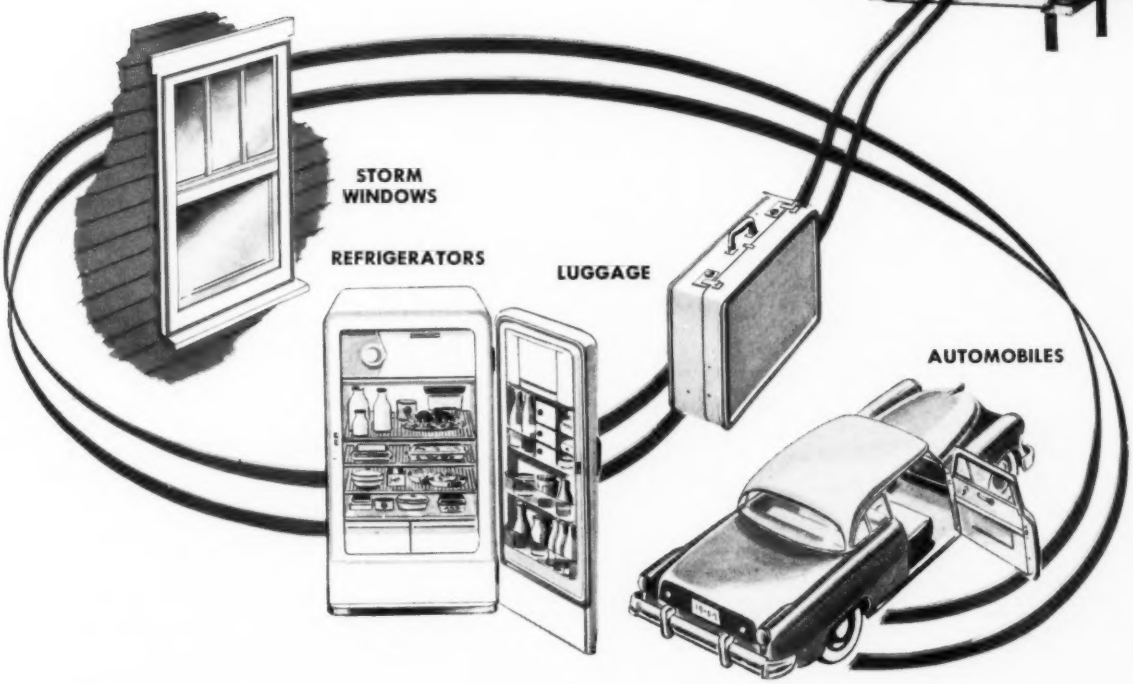
DIAMOND ALKALI CHEMICALS ®

Pittsburgh PX Plasticizers add *Versatility* to your Vinyl EXTRUSIONS





WHERE you work, where you live, where you travel . . . you see more and more vinyl extruded products in use every day. Their exceptional ability to conform in shape, size and color to end product use is just one reason for their rapidly growing popularity. In addition, they offer unusual resistance to chemicals and aging, excellent shape retention and easy workability.

Formulating—and retaining—these desirable properties in vinyl plastic extrusions calls for the use of plasticizers with outstanding permanence and flexibility characteristics. To achieve these qualities, the Auburn Button Works, Inc., Auburn, New York, uses Pittsburgh PX Plasticizers in its extruded products and in many other high quality vinyl products. From experience, Auburn knows the benefits of buying from a basic producer. *And Pittsburgh is basic.*

We quality-control every step of plasticizer production from coal to finished plasticizer. *You* benefit by the assurance of top uniform quality in every drum, tank truck or tank car shipment. If you'd like to enjoy benefits like these, call one of our representatives in Pittsburgh, New York, Cleveland or Los Angeles. He'll welcome the opportunity to discuss your problems and make money-saving recommendations.

W&D 5136

Please call on us at Booth 238 and 242 at the 6th National Plastics Exposition, June 7-10 in Cleveland

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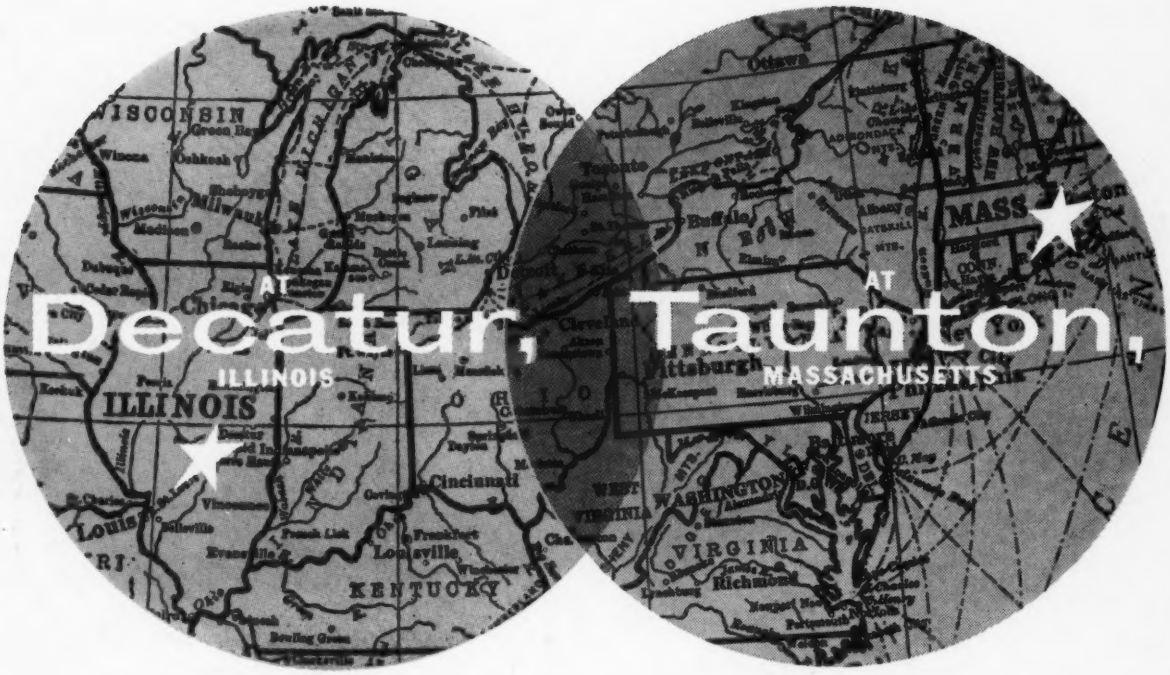

EXPANDED FACILITIES at General Electric's plastics molding plants in Decatur, Illinois, and Taunton, Massachusetts, now provide Midwestern and Eastern manufacturers with *all-under-one-roof* centers for dependable plastics parts.

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